Proceedings of the Central Committee of Chota Nagpore Agricultural Show for 1865 *held at Ranchee,* 30*th June* 1865.

PRESENT:

LIEUT.-COL. E. T. DALTON ... *President.*
MAJOR J. S. DAVIES ... *Vice-President.*
MR. H. STAINFORTH, MR. H. L. OLIPHANT, MAJOR J. L. NATION, } *Members.*

READ the letter from the Secretary to the Government of Bengal, No. 3028 of the 25th April last, directing the Commissioner to make early arrangements for an Agricultural Exhibition in this Division for the year 1866.

The Commissioner and President informs the Committee that on receipt of the above instructions he addressed the Deputy Commissioners of Lohardaggah, Hazareebagh, Maunbhoom and Singbhoom, requesting them to re-appoint and convene their respective District Committees, and after consultation to submit their views and wishes in regard to the proposed Agricultural Exhibition, and to report what support the Central Committee could calculate upon.

Replies have been received from all the Deputy Commissioners.

The Deputy Commissioner of Lohardaggah intimates that the undermentioned Gentlemen have kindly expressed their willingness to serve on the District Committee:—

Major J. L. Nation.
Lieutenant E. G. Lillingston.
Pergunait Roy.
Jugut Paul Sing Bahadoor.
Baboo Manoram Tewaraee.
H. L. Oliphant, Esq.

The Committee of this District are of opinion that after the experience of last year the Exhibition will be more likely to be successful if held at Chooteah, near Ranchee, in connection with the Annual Fair, than if held at any other place.

They proposed to call on the Zemindars, &c. for contribution and support, but the result of this requisition has not yet been communicated.

The Deputy Commissioner of Hazareebagh reports that the following Gentlemen have been appointed Members of the District Committee:—

Major H. M. Boddam ... *President and Secy.*
James Westland, Esq.
Captain H. P. Wynch.
Max. Liebert, Esq.
Moharajah Ramnath Singh.
Baboo Kalidas Paulit.
C. Bedford, Esq.

At the first meeting of the Committee a sum of Rupees 750 in aid of the Exhibition was subscribed in the room, and the Committee all join in a recommendation to the Central Committee that the next Exhibition be held at Hazareebaugh.

Major Boddam as Deputy Commissioner strongly supports this recommendation, and expresses his belief that if he would obtain an assurance that his station would be selected, he would have no difficulty in collecting some 2,000 or 3,000 Rupees in furtherance of it.

The Deputy Commissioner of Maunbhoom reports that in accordance with the instructions received, he convened a meeting of the Members of the Committee, which was attended by the Gentlemen whose names are noted in the margin.

Lieutenant R.-C. Money.
A. Weekes, Esq.
E. T. Dalton, Esq.
Baboo Rakhal Dass Haldar.
" Hungseshur Mookerjee.
" Kali Churn Dutt.
" Nobeen Chunder Paul.
" Isshur Chunder Ghosaul.
Rajah Mokoond Narain Deo.
" Strooghna Narain Deo.
" Pertab Narain Singh.
" Kassinath Singh.
" Kessub Lall Misser.
" Sheik Neeamutoollah.
Koylas Chunder Chatterjee.
Chota Rajah Joggeebun Lall Deo.
Bene Madhub Roy.
Sham Lall Dutt.

The Committee were of opinion that the Zemindars and other Gentlemen of Maunbhoom were not at present likely to be benefitted by or to support Agricultural Shows held at Ranchee, and suggest that the next Exhibition be held in the Maubhoom District at some position near the railroad, as they consider that it would then be more likely to attract Visitors and Exhibitors from other Districts.

Should this suggestion not be approved, they ask permission to hold a Local District Show about a fortnight before the time fixed for the Divisional Exhibition. The necessary funds will, they say, be provided by the Zemindars, and they have for the purpose about Rupees 1,000 in hand.

It would be arranged as one of the conditions of this Local Show that all cattle and produce for which prizes were taken should be sent to the Divisional Exhibition.

The Deputy Commissioner of Singbhoom reports that the following Gentlemen have kindly offered to act as a Local Committee in his District:—

W. H. Hayes, Esq.
Dr. S. J. Manook.
Mr. J. H. Thompson.
Rajah Chukerdhur Singh Bahadoor.
Rajah Jugernath Dhul.
Thakoor Rugghoonath Singh.
Thakoor Lokenath Singh.

The Committee appointed Sub-Committees for the Colehan and Porahat, for Seraikillah, for Khursowan and for Dhulbhoom.

The Members and other Zemindars and Farmers, &c., attending the meeting, all recommend that the Exhibition be held at Ranchee in connection with the Chooteah Fair.

A number of prizes, aggregating Rupees 237, for cattle and produce offered by Gentlemen of Singbhoom, are placed at the disposal of the Central by the Singbhoom Committee, for which the Central Committee tender their acknowledgments.

The Central Committee have given to the proposal of the Hazareebagh Committee the full consideration that it merited. They are fully sensible of the liberality of the offer and the advantages that Hazareebagh possesses as a site for the Divisional Agricultural Exhibition; but with reference to the wish generally expressed by the Native community at the meeting held after the last Show in March last, and to the proceedings and opinion of the Lohardaggah and Singbhoom District Committees above quoted, they are of opinion that if sufficient funds are available, the next Divisional Show should be held as was the last at Chooteah, near Ranchee, during the last week of the Annual Fair.

The meeting in March above alluded to was very numerously attended by Native Gentlemen from the Tributary Mehals and all parts of the Division. The Commissioner suggested to them that there would be advantages in holding the next Exhibition at some place nearer to the great lines of communication than is Ranchee; but they unanimously expressed their preference for Ranchee, and whilst apparently willing to give their support to the Exhibition if held there, they very generally evinced a reluctance to have anything to do with it if held elsewhere.

The Commissioner has already intimated to the Maunbhoom Committee that he has no objection to the proposed preliminary local Exhibition, but, for the reasons above given, he does not think that the next Agricultural Show would be attended with any benefit to the Division if it were held in the Maunbhoom District.

The Central Committee therefore invite the aid of the District Committees in organizing a show of cattle, produce and implements, to be held at Ranchee in connection with the Annual Chooteah Fair, commencing on the 1st February next. The Show should open on or about the 10th February, so as to be held during the last days of the Fair.

The District Committees are reminded that the Government have this year made no grant for the expenses of the Show. The advance authorized is to be repaid from the proceeds, and as the Central Committee do not expect to receive much from the sale of tickets of admission, they request the District Committees will have the goodness to report as speedily as possible what sums they can each contribute for the general purposes of the Exhibition.

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No. 35.] [565]

SUPPLEMENT TO

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WEDNESDAY, OCTOBER 4, 1865.

OFFICIAL PAPERS.

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Report on the Cultivation of Cinchonæ at Darjeeling during the month of July 1865.

From T. ANDERSON, ESQ., M. D., Superintendent, Botanical Gardens, and in charge of Cinchona Cultivation in Bengal, to S. C. BAYLEY, ESQ., Junior Secretary to the Government of Bengal,—(No. 22, dated the 4th September 1865.)

I HAVE the honor to submit, herewith, the Report on the cultivation of Chinchonæ at Darjeeling during the month of July 1865.

Report on the Cultivation of Cinchonæ at Darjeeling during the month of July 1865.

THE progress of the Cinchona plants has been most satisfactory during the month of July. The growth at all the experimental Plantations shews a great increase compared with that of previous months, while the increase by cuttings during the month has exceeded 14,000, a greater number than has ever been obtained since the commencement of the cultivation at Darjeeling. The Table shewing the growth of certain measured plants during the month, may mislead those who take an interest in these reports of the progress of Cinchona cultivation. The growth recorded in these Tables is merely that of certain measured plants, and does not shew the greatest growth made during the month. Among the 3,256 plants permanently planted out, there are many larger than these measured plants. At the 5th Plantation there are about 370 plants of C. Succirubra, the majority of which are above 3 feet in height, while about 10 plants in addition to those numbered are 4 feet. At the 4th Plantation there are about 200 permanently planted out specimens of C. Officinalis, varying from 2 to 4½ feet in height, while at the 3rd Plantation there are 450 plants of this species about 18 inches high. The maximum and minimum growth made by the plants at the two Upper Plantations shews a great improvement in the vigour of these species at the higher elevations.

2. The weather during July was marked by great humidity, and a high temperature, and by cloudy misty days. Rain fell on every day with the exception of two; the amount of rain registered during the month at the 4th Plantation was 44·4 inches. The total rain-fall at this Plantation between 1st January and 31st July has been 95·58 inches.

The mean maximum temperature at the 4th Plantation was 87·10, the mean minimum 67·9, and the mean temperature of the month 77·54.

Table shewing Maximum and Minimum growth of species of Cinchonæ during July at five different altitudes.

Name of Species.	First Plantation, maximum and minimum growth.	Second Plantation, maximum and minimum growth.	Third Plantation, maximum and minimum growth.	Fourth Plantation, maximum and minimum growth.	Fifth Plantation, maximum and minimum growth.
C. Succirubra ...	...	...	½ to 1 Inch.	1½ to 5⅝ Inches.	1⅛ to 9 Inches.
C. Micrantha ...	...	...	2½ Inches.	9 to 12½ „	7 Inches.
C. Officinalis ...	½ to 1 In.	¼ to 8¾ Ins	⅜ to 3¾ Inches.	1¼ to 7¼ „	⅜ to 7¼ Inches.
C. Pahudiana ...	¼ to 5 Ins.	½ to 2½ „	2 to 5 „	1 to 13½ „	4 to 8¼ „

3. The following Tables shew the distribution and number of the plants on 31st July, as well as the growth of the measured plants during that month.

Number and distribution of Cinchona plants in the Government Plantations at Darjeeling on the 1st August 1865.

Name of Species of Cinchonæ.	Number in permanent plantation.	Number of stock plants for propagation.	Number of seedlings or rooted cuttings in nursery beds for permanent plantation.	Number of rooted cuttings in cutting beds.	Number of cuttings made during the month.	Total number of plants, cuttings and seedlings.
C. Succirubra ...	389	4,391	None	17,070	6,634	28,484
C. Calisaya ...	None	23	...	54	20	97
C. Micrantha ...	15	929	...	1,610	620	3,174
C. Officinalis, including varieties ...	690	18,639	...	17,721	7,020	44,070
C. Pahudiana ...	2,162	None	2,930	None	None	5,092
Total ...	3,256	23,982	2,930	36,455	14,294	80,917

TABLE shewing the growth of Cinchonæ at the Rungbee Plantations during July 1865.

Name.	Number.	1st Plantation, Altitude 5,500 feet.					2nd Plantation, Altitude 4,350 feet.					3rd Plantation, Altitude 3,715 feet.					4th Plantation, Altitude 2,500 feet.					5th Plantation, Altitude 1,825 feet.				
		Date of planting.	Height in inches when planted.	Height on 1st July.	Height on 1st August.	Growth in July.	Date of planting.	Height in inches when planted.	Height on 1st July.	Height on 1st August.	Growth in July.	Date of planting.	Height in inches when planted.	Height on 1st July.	Height on 1st August.	Growth in July.	Date of planting.	Height in inches when planted.	Height on 1st July.	Height on 1st August.	Growth in July.	Date of planting.	Height in inches when planted.	Height on 1st July.	Height on 1st August.	Growth in July.
C. Succirubra	1	1864.					1864.					29th June. .	18½	26½	27	0¾	29th July ...	5	16½	16½	...	29th July ...	6	33½	35¼	2
Ditto ...	2	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	17½	23¾	23¾	...	29th „ ...	6	16½	16½	...	15th Oct. ...	10½	24¼	26	1¾
Ditto ...	3	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	16	22¼	23	0¾	29th „ ...	7½	22½	27½	5¼	29th July ...	3½	10½	12½	2
Ditto ...	4	.....	...	...	...	...	.....	...	...	...	...	29th July ...	6	12¼	12¾	0½	15th Oct. ...	10	12½	12½	...	29th „ ...	3	13½	13½	...
Ditto ...	5	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	6	17½	18½	1	29th July ...	4½	13	18	5	29th „ ...	5½	32	35½	3½
Ditto ...	6	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	4½	16¾	18¼	1½	29th „ ...	3	30½	39¼	9
Ditto ...	7	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	3½	16¼	22	5¾	29th „ ...	4	15½	..	..
Ditto ...	8	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	2	8½	8½	...	29th „ ...	4½	28½	32½	3¾
Ditto ...	9	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	3	16	17½	1½	29th „ ...	4	30½	34½	4
Ditto ...	10	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	3	22¾	22¾	...	29th „ ...	3	18½	25½	7¼
C. Micrantha	1	.....	...	...	...	...	.....	...	...	...	...	29th July ...	5	8½	8¼	...	15th Oct. ...	9	17¼	17¼	...	29th „ ...	5½	36	36	...
Ditto ...	2	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	7½	11½	14¼	2¾	15th „ ...	6½	15	27½	12½	29th „ ...	6	25	32	7
Ditto ...	3	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	6	10½	10½	...	29th July ...	3	21¾	32	10¼	15th Oct. ...	6	6½	6½	...
Ditto ...	4	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	5	8½	8½	...	29th „ ...	2½	7¾	7¾	...	29th July ...	4½	8½	8½	...
Ditto ...	5	.....	...	...	...	...	.....	...	...	...	...	25th „ ...	5½	9	9	...	29th „ ...	3	20½	29½	9	15th Oct. ...	5½	11	11	...
C. Officinalis	1	15th Dec. ..	8½	10¾	10¾	...	15th Dec. ...	8½	12½	12½	...	4th „ ...	8½	13¾	16½	2¾	15th Oct. ...	4	23¾	29	5¼	15th „ ...	5	6	6	..
Ditto ...	2	15th „ ...	7½	8½	8½	...	15th „ ...	11½	13½	14	0½	15th Oct. ...	6	10	10	...	15th „ ...	5½	20¼	27	6¾	15th „ ...	4½	30½	34½	4
Ditto ...	3	15th „ ...	6½	8½	8½	...	15th „ ...	6½	9¼	10½	1¼	15th „ ...	5	8	11½	3½	15th „ ...	4½	14	17	3	15th „ ...	5	19	24	5
Ditto ...	4	15th „ ...	6½	7	7½	0½	15th „ ...	6	8¼	9	0¾	15th „ ...	5	6¾	6¾	...	15th „ ...	5½	26½	33¾	7¼	15th „ ...	4	20½	26¾	6¼
Ditto ...	5	15th „ ...	5¼	6	7	1	15th „ ...	7	11	11¾	0¾	15th „ ...	5	8¼	8¼	...	15th „ ...	5	30½	34¼	4¼	15th „ ...	6	21½	28¾	7¼
Ditto ...	6	15th „ ...	5¼	6½	6½	...	15th „ ...	6½	9½	9½	...	15th „ ...	5½	7¼	7¼	...	15th „ ...	4½	23	23	...	15th „ ...	4½	8½	9	0½
Ditto ...	7	15th „ ...	5	7½	7½	...	15th „ ...	6	10¾	19½	8¾	15th „ ...	4	12¼	13	0¾	15th „ ...	5½	7½	8½	1¼	15th „ ...	5	15	15	...
Ditto ...	8	15th „ ...	4	4	4	...	15th „ ...	7¼	12¼	12¼	...	15th „ ...	5	6½	6½	...	15th „ ...	4½	16¼	23½	7	15th „ ...	5½	9	13½	4½
Ditto ...	9	15th „ ...	4½	5½	6	0½	15th „ ...	7	15	17	2	15th „ ...	6	8	8	...	15th „ ...	4	28	34¾	6¾	15th „ ...	4	10½	11	0¾
Ditto ...	10	15th „ ...	10	13½	13½	...	15th „ ...	7½	8½	8¾	0¼	15th „ ...	5½	12¾	16½	3¾	15th „ ...	3	14	19½	5½	15th „ ...	4½	12½	12½	...
C. Pahudiana	1	15th „ ...	5	6½	10¾	4¼	15th „ ...	5	7¼	9	1¾	4th July ...	5	14¼	14¼	...	15th „ ...	7½	17¼	25	7¾	15th „ ...	7½	9¾	9¾	...
Ditto ...	2	28th Mar./65	5	5¾	6	0¼	15th „ ...	4	4½	5	0½	4th „ ...	5½	14¾	14¾	...	15th „ ...	4½	9	22½	13½	29th July ...	1½	6	6	...
Ditto ...	3	28th „ „	3	6¼	6¾	0½	15th „ ...	4½	6	8½	2¼	4th „ ...	3	14	17¾	3¾	29th July ...	3	26¼	29	2¾	29th „ ...	2	27	33½	6½
Ditto ...	4	15th Dec./64	2½	3	3	...	15th „ ...	5	7½	9	1½	4th „ ...	2	8¼	11½	3	29th „ ...	3	22¼	27¾	5½	29th „ ...	3	28	35¼	7¼
Ditto ...	5	15th „ „	2¾	5¾	5¾	...	15th „ ...	5	5	6	1	4th „ ...	3	8	11¾	3¾	29th „ ...	3	10¼	20	9¾	29th „ ...	2½	6½	6½	...
Ditto ...	6	15th „ „	2½	4½	4½	...	15th „ ...	5½	11½	11½	...	4th „ ...	3	17½	22½	5	29th „ ...	3	15¼	21	5¾	29th „ ...	1½	22¾	28	5¼
Ditto ...	7	28th Mar./65	3½	5	5	...	15th „ ...	4½	5	5	...	4th „ ...	2	14½	16¾	2	29th „ ...	3	17	18	1	29th „ ...	2	26	34½	8½
Ditto ...	8	15th Dec./64	2¾	2¾	2¾	...	15th „ ...	5½	7	7	...	4th „ ...	2½	11¾	15¾	4	29th „ ...	3½	14½	18¾	4¼	29th „ ...	2¼	4¼	4¼	...
Ditto ...	9	15th „ „	4¼	4¾	6	1¼	15th „ ...	2½	3¾	3¾	...	4th „ ...	2½	12½	12½	...	29th „ ...	3	10¼	19¼	9	29th „ ...	1½	22¼	27¾	5½
Ditto ...	10	15th „ „	2¾	3	8	5	15th „ ...	3½	4	4	...	4th „ ...	3	19	23	4	29th „ ...	3	10	19	9	29th „ ...	4	18	22	4

Darjeeling,
The 1st August 1865.

T. Anderson, M. D.,
Superintendent, Botanical Gardens, and in charge of Cinchona Cultivation in Bengal.

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SUPPLEMENT TO

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Meteorological Observations.

From S. C. BAYLEY, ESQ., Junior Secretary to the Government of Bengal, to the Secretary to the Government of India, Home Department,—(No. 1059, dated the 20th February 1865.)

THE Lieutenant-Governor desires to draw the attention of the Government of India to the necessity, which the experience of the Cyclone of 5th October has made abundantly manifest, for establishing at the Port of Calcutta and along the Coast of the Bay of Bengal within the region of Typhoons, (that is to say, from Rangoon to Madras,) a system of Meteorological Observation similar to that which is now in operation in the United Kingdom under the direction of Admiral Fitzroy, and to that which His Honor believes already exists at Bombay, whereby not only may timely notice be given to the Masters of Vessels in Port and within sight of the Coast of the probable approach of bad weather, but the conditions of the atmosphere at various points may be carefully recorded and communicated to the Meteorological Department in England, to the Bombay Observatory and elsewhere, with a view to the general promotion of Meteorological science, especially in its practical bearing on navigation and on the safety of life and property within the influence of such storms as that with which Bengal has been lately visited with such destructive consequences.

2. The Lieutenant-Governor has hitherto abstained from entering on this subject because the Observatory in Calcutta, where alone Meteorological Observations are made and recorded, is superintended by the Surveyor-General of India under the orders of the Government of India, and His Honor was also aware that the Government of India has lately been in communication with the Asiatic Society, in consequence of a proposal made by the Meteorological Committee of the Society, to place the Observatory on a more efficient footing with a view, however, rather to the bearing of Meteorology on the measures to be taken for the preservation and improvement of the public health than to its important influence on the safety of the shipping resorting to Calcutta and other Ports in the Bay of Bengal, of other property liable to be damaged by violent storms, and of the lives of those who are exposed to their fury either at sea or within the reach of the storm-wave on land.

3. With a view, therefore, of establishing a system of Meteorological Observation on the more extended basis indicated in the first paragraph of this letter, the Lieutenant-Governor has determined to appoint a Committee composed of the gentlemen whose names are entered in the margin, for the purpose of considering the whole question of drawing up a practical scheme for giving effect to the object in view.

Captain J. F. Tennant.
Mr. H. F. Blanford.
„ J. Obbard.

From S. C. BAYLEY, ESQ., Junior Secretary to the Government of Bengal, to LIEUTENANT-COLONEL J. E. GASTRELL, H. F. BLANFORD, ESQ., and J. OBBARD, ESQ.,—(Nos. 1808-10, dated 11th March 1865.)

WITH a view of establishing a system of Meteorological Observations at the Port of Calcutta and along the Bay of Bengal, the Lieutenant-Governor has resolved to appoint you to form a Committee for the purpose of considering the question and of drawing up a practical scheme for giving effect to the object in view.

2. A copy of a letter No. 1059, dated the 20th ultimo, addressed to the Government of India in the Home Department on the subject is herewith forwarded for your information.

From H. F. BLANFORD, ESQ., Honorary Secretary to the Meteorological Committee, to the HON'BLE A. EDEN, Secretary to the Government of Bengal,—(No. 1, dated the 6th April 1865.)

WITH reference to your letter Nos. 1808-10, dated 11th March 1865, and its enclosure, No. 1059 of 20th February 1865, I have the honor to inform you that the Committee appointed by His Honor the Lieutenant-Governor has resolved to recommend that a Meteorological Observing

Station be established at Saugor Island as early as practicable, as a first step towards the formation of a more extended system. The position of Saugor Island on the Seaboard to the south of the Port of Calcutta, and in the direction from which the most severe storms approach this Port, renders it peculiarly fitted for a post from which warning may be given of approaching bad weather, and being in telegraphic communication with Calcutta by a line, which is but little liable to injury and consequent interruption, nothing more will be required than to furnish the Station with instruments, and to provide for their observation and record by one of the residents at the Station.

2. The Committee having placed themselves in communication with Colonel Douglas, the Director-General of Telegraphs for India, and Colonel Thuillier, the Surveyor-General, has received those gentlemen's most cordial co-operation, and have obtained their concurrence in the scheme, which I have now the honor to submit for His Honor's consideration.

3. It is propsed that three daily observations of the Barometer, dry and wet bulb Thermometer, wind (force and direction) and clouds (for upper wind currents) be taken by the Assistant in charge of the Telegraph Station and telegraphed in accordance with Admiral Fitzroy's system to the Surveyor-General's Office in Calcutta. These messages will take precedence of shipping and all private messages. At the Surveyor-General's Office the observations will be reduced immediately on receipt and transmitted together with those made synchronously at the Calcutta Observatory to one of the Members of the Committee living in the immediate neighbourhood, and also to the Master Attendants. It is proposed that signals of the Fitzroy pattern which are now well understood by all seamen be provided at the Master Attendant's, the Fort or some other convenient and prominent position, and Saugor Island to be hoisted, in case of bad weather being expected, on intimation to that effect being transmitted from the Surveyor-General's Office through the Master Attendant and the Telegraph. The Committee believe that, as a temporary measure, they will be able to take charge of the working, of the system, and that they may thus gain experience, which will be valuable to them in making arrangements for its extension.

4. While, however, the Committee are prepared thus to initiate the system, they would wish it to be fully understood that they do not consider it possible to make any reliable prediction of the weather until the laws of the local atmospheric changes are ascertained. Of these laws nothing whatever is known at present, and it is only by unremitting attention to the data obtained during the first year or two, and a careful scientific collation of them that a firm basis will be laid for carrying out the above important object of the system.

5. They would recommend that a salary of Rupees 50 a month be sanctioned, as a special allowance, to the Assistant of the Telegraphic Department at Saugor Island for performing the additional work which Meteorological Observation will impose on him. The instruments can be furnished on indent from the Government Stores or the equipment of the Saugor Station, but it is recommended that for the extension of the system instruments of uniform pattern manufactured specially to order and tested and corrected at the Kew Observatory previous to shipment be provided. Should this proposition receive His Honor's approval the Committee will submit a specification of the instruments they would propose to provide without delay.

6. The Committee will draw up and print concise Rules for the guidance of Observers, and they would furnish them with a copy of Admiral Fitzroy's, or some other work on Meteorology.

7. The Committee would further strongly recommend that an Observing Station be also established at Port Blair in the Andaman Islands. Although this Station is not in telegraphic communication with Calcutta, and the observations taken there can only be transmitted by the monthly Mail, its position near the focus from which the Cyclones of the Bay of Bengal almost invariably proceed renders it of great importance as a Station, the records of which may be expected to throw much light on the Meteorology of the Bay, with a view to deducing the laws of the prevailing wind currents as above specified; it is only by a knowledge of these latter that the telegraphic system can be made of the greatest utility in affording a pre-knowledge of atmospheric disturbances.

8. With a view to the same object the Committee would recommend that observations be made at False Point and on board the light vessels stationed at the Pilots' ridge and the Eastern Channel under instructions that will be furnished by the Committee, and that these be forwarded as opportunity may serve to the Surveyor-General's Office, (through the Master Attendant). These observations will cost nothing to Government beyond the provision of the instruments.

9. The coast line of Telegraph to Madras does not at present communicate with the East Coast at any point within the Bengal Presidency. It is, however, very desirable that at least one Station on that Coast should forward a daily telegram to Calcutta, and it would be a great advantage were observations recorded at more than one Station and transmitted daily. With a view to this arrangement the Committee solicit that they be permitted to place themselves in communication with the Government of Madras. They would suggest that by adopting this course and reporting their proceedings to the Government of Bengal expedition will be secured, and they trust that speedy extension may thus be given to a system of Meteorological intercommunication, which will very much enhance the value of the results.

From the Hon'ble A. Eden, Secretary to the Government of Bengal, to H. F. Blanford, Esq., Honorary Secretary to the Meteorological Committee,—(No. 2909, dated the 20th April 1865.)

I am directed to thank you for your Report No. 1, dated the 6th instant. The Committee's recommendations have the Lieutenant-Governor's entire approval and, with reference to the 5th paragraph, I am to request that the Committee will be so good as to submit an indent to the Mathematical Instrument Department for the instuments required for the proposed Observing Stations at Saugor, False Point, and the Light Ships.

2. The Government of India has been addressed in regard to the other propositions of the Committee, in my letter No. 2011, dated this day, a copy of which is forwarded herewith.

From the HON'BLE A. EDEN, Secretary to the Government of Bengal, to the Secretary to the Government of India, Home Department,—(No. 2911, dated the 20th April 1865.)

IN continuation of letter from this Office No. 1059, dated the 20th February last, I am directed to submit copy of a Report, dated the 6th instant, drawn up by the Meteorological Committee appointed to consider the subject of establishing a system of observations along the coast of the Bay of Bengal and at the Port of Calcutta.

2. I am at the same time to request the sanction of His Excellency the Governor General in Council to the allowance of Rupees 50 per mensem asked for on account of the Assistant of the Telegraph Department at Saugor Island, who may be charged with the duty of recording observations.

3. The Lieutenant-Governor also requests that His Excellency in Council may be moved to instruct the Director-General of Telegraph Department and the Surveyor-General to give effect to the Committee's recommendations.

4. The proposition of the Committee, contained in the 7th paragraph of their letter, in regard to the establishment of an Observing Station at Port Blair, will probably commend itself to the favorable consideration of the Government of India, and His Honor suggests that a similar step might, perhaps, with advantage be taken at the new Light House on the Alguada Reef.

5. I am to request that permission be given to the Committee to place themselves in communication with the Government of Madras, in accordance with their suggestion in paragraph 9.

From J. GEOGHEGAN. ESQ., Under-Secretary to the Government of Bengal, to the Master Attendant,—(No. 2912, dated the 20th April 1865.)

I AM directed to forward, for your information, copy of a letter, No. 1, dated the 6th instant, from the Secretary to the Meteorological Committee appointed by the Lieutenant-Governor, and to request that you will be so good as to place yourself in communication with the Committee, in view to the establishment of a system of weather signals in accordance with their suggestions, and in order to the issue of proper orders to the Officers in charge of the Light House at False Point and of the Light Ships.

From A. P. HOWELL, ESQ., Under-Secretary to the Government of India, Home Department, to the HON'BLE A. EDEN, Secretary to the Government of Bengal,—(No. 1175, dated Simla, the 27th May 1865.)

I AM directed to acknowledge the receipt of your letters noted on the margin, on the subject of establishing a system of Meteorological Observations along the coast of the Bay of Bengal and at the Port of Calcutta.

No. 1059, dated 20th February 1865.
No. 2911, dated 20th April 1865.

2. In reply I am directed to state that a special allowance of Rupees 50 per mensem for the Assistant of the Telegraph Department at Saugor Island, who may be charged with the duty of recording observations, will be recommended to the Financial Department.

3. The Director-General of the Telegraph Department and the Surveyor-General of India will be requested to give effect to the recommendations of the Meteorological Committee.

4. The Chief Commissioner of British Burmah will be consulted in regard to the proposed establishment of Observing Stations at Port Blair and on the Alguada Reef.

5. A copy of this correspondence will be forwarded to Madras, with a request that that Government will be good enough to cause any information or assistance that may be available to be afforded to the Meteorological Committee.

From LIEUTENANT-COLONEL C. DOUGLAS, Director-General of Telegraphs in India, to the HON'BLE A. EDEN, Secretary to the Government of Bengal,—(No. 635, dated the——June 1865.)

UNDER instructions from the Government of India, I am prepared to give effect to the recommendation of the Meteorological Committee, *viz.*, that a special allowance of Rupees 50 per mensem shall be made to the Assistant in charge of the Telegraph Office at Saugor Island, who will be charged with the duty of recording observations, as soon as the necessary arrangements are completed for commencing observations.

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No. 37.]

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SUPPLEMENT TO

The Calcutta Gazette.

WEDNESDAY, OCTOBER 18, 1865.

OFFICIAL PAPERS.

A Supplement to the Gazette will henceforward be published, containing such Official Papers and Information as the Government of Bengal may deem to be of interest to the Public, and such as may usefully be made known.

Non-Subscribers to the Gazette may receive the Supplement separately on a payment of six Rupees per annum if delivered in Calcutta, or twelve Rupees if sent by Post.

No Official Orders or Notifications, the publication of which in the Gazette is required by Law, or which it has been customary to publish in the Gazette, will be included in the Supplement. For such Orders and Notifications the body of the Gazette must be looked to as heretofore.

Report on the Moorings of the Port of Calcutta.

From Captain H. Howe, Deputy Master Attendant, in charge, to the Secretary to the Government of Bengal,—(No. 2525, dated the 20th October 1864.)

With reference to the latter part of the 3rd paragraph of your letter No. 4141T of the 11th instant, I have the honor to submit, for the consideration of the Lieutenant-Governor, that it may be desirable to appoint a Committee to report upon the Moorings of the Port, the cause of Ships having been driven from them during the late Hurricane, and the best mode of re-laying them with our present appliances of heavy anchors, chains, and posts, pending the consideration ultimately of the question of Screw Moorings.

2. If His Honor would permit me, I would beg to suggest the President of the Chamber of Commerce as President, Lloyds' Surveyor as one Member, and any other scientific and practical men that His Honor may see fit to elect.

From S. C. Bayley, Esq., Junior Secretary to the Government of Bengal, to the Hon'ble J. N. Bullen,—(No. 4460, dated the 24th October 1864.)

I am directed to inform you that the Lieutenant-Governor has been pleased to appoint you to be President of a Committee, whereof the gentlemen named on the margin are appointed Members, to consider and report on the questions proposed by the Deputy Master Attendant in the accompanying copy of a letter No. 2525, dated the 20th instant, and on the adaptability of Screw Moorings to the circumstances of the Port. It is a question, the Lieutenant-Governor thinks, whether, with reference to cost and durability, as well as to the greater safety of the Shipping and to economy of space in the Port, it is not on the whole desirable that these Moorings should be generally substituted for those heretofore in use, and you are requested to consider what means exist for carrying out such a change, either gradually or at once.

Captain A. Fraser, R. E.
" H. Hyde, R. E.
" H. Howe.
Mr. G. Ross.

From the Hon'ble J. N. Bullen, President, Calcutta Moorings Committee, to the Secretary to the Government of Bengal,—(dated the 28th November 1864.)

In the letter No. 4460, dated 24th October 1864, from the Junior Secretary to the Government of Bengal, appointing me the President of a Committee ordered to consider and report on certain questions proposed by the Deputy Master Attendant in his letter No. 2525, dated 20th October, it was requested that the Committee should consider whether it is not, on the whole, desirable that Screw Moorings should be generally substituted for those heretofore in use in the Port of Calcutta, and as to what means exist for carrying out such a change, either gradually or at once.

2. Bearing in mind the necessity which exists of providing safe moorings previously to the advent of the freshes next South-West Monsoon, and of indenting at once upon England for a large supply of moorings in the place of those which may be deemed irrecoverable, the Committee have resolved to report, (in anticipation of their general report on the several questions which are before it,) for the information of His Honor the Lieutenant-Governor of Bengal, the conclusions they have arrived at on the question of the adaptability of Screw Moorings to the circumstances of this Port, so that, should His Honor concur in the views held by the Committee, arrangements may be at once made for obtaining from England a supply of these moorings instead of indenting for further supplies of a description of mooring which has been proved insecure, and consequently unfitted for the purpose for which it is required.

3. It has been proved before this Committee that many of the moorings gave way before the real strength of the gale (5th October) came on; and that while in some cases the chains have parted, in others the heaviest moorings of the Port, anchors, chains, and all, have been carried bodily to the other (Howrah) side of the river and to Cossipore. It has been further proved that, while in some instances the ships' chains parted, in the generality of cases the mooring chains (although of thicker iron) have given way. But

the Committee observe that there has been nothing yet before them to shew that there has been any neglect on the part of the Authorities appointed to the charge of the moorings.

4. It does not seem to the Committee a matter for their consideration whether it be possible that any kind of moorings can be found which would uniformly hold the vessels in the Port in such a Cyclone as occurred on the 5th of October last, but there is no doubt in their minds as regards the superiority generally of a system of Screw Moorings over that hitherto in use, and especially of the value (having in view the small space in which the vessels have to be moored) as a holding power, of the screw itself, as adopted in many Ports at Home, over the heaviest anchor in use in the Port. The Committee being further of opinion that, by adopting the screw system, the Government will not only secure the most efficient known means of mooring ships, but also the most economical, are unanimous in recommending that these means should be at once obtained and put into use for the Port of Calcutta.

5. The Committee consider the matter, as regards the strength of the screw moorings, to be purely an engineering question, though the precise manner of applying them, and the position in which they should be laid, would be guided by those who have the best nautical knowledge of the circumstances of the Port and of the ships visiting it; and although the Committee have no doubt of the strength of these moorings, yet the engineering experience necessary for laying them down to the best advantage is not to be found in India. The Committee therefore suggest, for the consideration of the Lieutenant-Governor of Bengal, that it will be well that the matter be at once referred to the Home Government, and that, on account of the urgent necessity of getting the vessels into safe berths before the periodical "freshes" come down in July or August of next year, after consultation with the Corporation of the Trinity Board and other Port Authorities who are said to have employed these Screw Moorings, a requisition be made for a sufficient number of them, with chains and appliances complete, on the principles most approved by those Authorities, and that these be at once despatched to India with competent persons and proper apparatus for laying them down. These should take the place of such moorings as cannot he recovered.

6. In making this requisition it will be necessary to send at the same time all the data procurable regarding the nature of the ground, (which is believed to be well known,) the strength and effect of the tides, currents or eddies, on vessels riding in the river, and a Chart of the positions in which the moorings will eventually have to be laid. With this information, and bearing in mind the inconsiderable weight of a screw as compared with an anchor, the Committee think that, while it is necessary to re-lay the moorings, so far as materials exist, on the system heretofore in use, there is quite sufficient time to obtain the materials for the change which the Committee recommend, in lieu of the anchors, &c., lost, before the rains set in.

7. The position in which the change should be first adopted might well be left to the Marine Department, but the Committee further suggest that, in re-arranging the moorings, those which are called second and third class moorings be altogether discarded, and the existing first class anchors be laid down in their places, the screw moorings being substituted for such first class anchors as may be deficient to complete the moorings of the Port before the freshes come down, such portion of the river side, as the Marine Department may decide on, being left clear for the purpose. After next South-West Monsoon, the Screw Moorings should, in the opinion of the Committee, be gradually substituted throughout.

8. It occurs further to the Committee to suggest, for the consideration of His Honor the Lieutenant-Governor of Bengal, that an Officer of the Government practically acquainted with the whole mooring system as it existed, and the causes of its failure, be deputed to England, so that every information may be at hand on the subject, and the necessity of any reference to India and consequent delay may be avoided.

From S. C. Bayley, Esq., Junior Secretary to the Government of Bengal, to the Master Attendant,—(No. 5480, dated the 1st December 1864.)

I am directed to forward to you the accompanying letter, dated 28th ultimo, from the President of the Calcutta Moorings Committee, reporting the conclusions at which the Committee have arrived on the questions submitted for their consideration, and to request that you will be good enough at once to prepare an Indent for Screw Moorings in accordance with the Committee's recommendation. In doing this you will probably find it convenient to place yourself in personal consultation with the Committee.

2. The Lieutenant-Governor is also desirous of receiving a report from you on the suggestion made in paragraph 8 of the Committee's letter, and would be glad to know if you could name any Officer well acquainted with the condition and requirements of this Port who is now in England, and who may be willing to afford the assistance of his experience and co-operation.

From Captain John G. Reddie, Master Attendant, to the Secretary to the Government of Bengal,—(No. 2993, dated the 3rd December 1864.)

In accordance with Mr Junior Secretary S. C. Bayley's letter No. 5480 of the 1st instant, I have the honor to forward an Indent for Screw Moorings for 100 ships, marked No. 1 in the accompanying Drawing of Screw Pile Moorings; these should be complete with chains, swivels, and a person should be sent out with the necessary appartus for screwing them down.

2. As I am not well acquainted with Screw Pile Mooring, I consulted Colonel Fraser, R. E., (one of the Committee,) and we agree there should be Sheer Screws as well as the regular Mooring Screws with continuous ground chains to keep the vessel from sheering.

3. I would suggest that Captain Hill, my First Assistant, now in England, be requested to put himself in communication with the India Office to answer any question that may arise regarding the state of the river. Captain Hill is intimately acquainted with the river and the system of mooring ships that has been followed in this Port.

4. I enclose also for transmission, for reference, a Chart of the River with the Moorings laid down and the general depth of water.

5. I have in store about 1,200 fathoms of 2¾ and 1,700 of 2-inch chain; but as we have only as yet picked up one set of Moorings out of 180, it is impossible for me to say how much of this, if not all, may be used for the Moorings now being re-laid. I therefore recommend that Screw Piles with chains complete be sent out with all despatch.

6. If these are sent round the Cape they will arrive too late for laying before the South-West Monsoon. I therefore recommend that fifty be sent Overland and a person with apparatus complete.

From S. C. Bayley, Esq., Junior Secretary to the Government of Bengal, to the Master Attendant,—(No. 5530, dated the 5th December 1864.)

With reference to your letter No. 2993, dated the 3rd instant, I am directed to inform you that the Indent submitted by you for Screw Moorings for 100 ships has been forwarded for compliance to England.

2. I am to take this opportunity to request that you will be so good as to return the original enclosure of the letter from this Office, No. 5480 of the 1st idem.

From the Hon'ble J. N. Bullen, President of the Committee on Moorings, to the Secretary to the Government of Bengal,—(dated the 17th April 1865.)

I have the honor to forward, for submission to the Lieutenant-Governor, a copy of the Proceedings of the Committee appointed by His Honor to report upon the Moorings of the Port of Calcutta, with their report thereon as well as on the other subjects subsequently submitted for their consideration as marginally noted.

Screw Pile Jetties.
" " Light Houses.
" " Beacons.

Proceedings of the Committee appointed by the Government of Bengal to report upon the Moorings of the Port, the cause of Ships having been driven from them during the late Hurricane, the best mode of re-laying them, and to enquire into the adaptability of Screw Moorings to the circumstances of the Port of Calcutta.

FIRST DAY.

Monday, 31st October 1864.

Present:

The Hon'ble J. N. Bullen, *President.*
Colonel A. Fraser, R. E.
Captain H. Hyde, R. E.
" H. Howe, *Deputy Master Attendant.*
Mr. G. Ross.

The President read the letter from the Government of Bengal appointing the Committee, Appendix A.

Also letter from the Deputy Master Attendant, in charge, to the Secretary to the Government of Bengal, No. 2527A., dated 20th October 1864, Appendix B.

The general scope of the enquiry having been fully discussed, it was decided to take evidence in the first place—

1*st.*—As to the condition of the Moorings before and after the Cyclone.

2*nd.*—As to the number of Moorings which existed, their class, and the conditions which determined that classification.

3*rd.*—The Regulations in force for periodical examination of Moorings and Chains.

4*th.*—The Regulations in force for securing that the heavier Moorings were made available for the largest vessels.

5*th.*—And generally on all points bearing on the present system of Moorings.

It was resolved to request the attendance of the Harbour Master, Mr. Peterson, before the Committee at its next sitting.

The President was requested to communicate with the Government of Bengal respecting the appointment of a Secretary.

The Committee adjourned to Wednesday, the 2nd November, at 10 A. M.

SECOND DAY.

Wednesday, 2nd November 1864.

Members Present:

The Chairman.
Colonel A. Fraser, R. E.
Captain H. Hyde, R. E.
Mr. G. Ross.

Mr. James Frederick Peterson was called in and examined.—

"I am Harbour Master, and have been so for the last 5 years. I was previously Deputy Harbour Master for 2½ years, and before that an Assistant Harbour Master for about 15 years. As Harbour Master the moorings were under my charge. There are in all 174 moorings, extending from below the New Mint to abreast of Bishop's College on the east bank. This number includes seven berths on the western bank near the Salt Golahs and Railway Jetty. The moorings were divided into classes,—1st, 2nd, and 3rd. The last-named were used exclusively for Inland Steamers, Pilot Brigs, and Government State Barges. There were 100 first class moorings. First class moorings are laid with anchors of about 70 cwt., say from 69 to 71 cwt. The old second class moorings were laid with anchors of from 50 to 66 cwt., but those lately laid have the same weight of anchors as first class moorings. Before the Cyclone the moorings were all in good order. There is a periodical examination of the moorings. The examination commences every year immediately after the termination of the freshes. By examination I mean that the rings carrying the mooring

chains, the backing anchor chains, the two pendants, and the keys of the shackles were overhauled. All below the mooring ring is not overhauled; that is, 20 to 24 fathoms of 2-inch chain, shackled on to 8 fathoms of 2¾-inch chain, which is shackled on to the mooring anchor. This examination is considered sufficient, unless there is reason to suppose that either the mooring anchor or backing anchor has dragged. The backing anchor has 15 to 25 fathoms of chain according to depth of water. The parties responsible for the examination are myself or my Deputy. The in-shore mooring is a 2-inch chain secured to a sâl post 2 feet square, embedded 20 feet in the soil; the ring of the 2-inch chain goes down to low water mark, where it is shackled on to the ship's chain. The longest moorings were reserved for the largest vessels. A ship of 1,000 tons would be the largest we should put into a second class mooring. I can give no evidence as to the state of the moorings after the gale. We have only one anchor boat in use, and she has been uninterruptedly on special service with vessels in distress since the gale. Nor have divers been available for the examination of the moorings. I believe, however, that all the mooring anchors were in their places. What gave way was either the No. 3 shackle or the ship's cables. The ships were all moored with their heads up stream. They parted with the wind at S. E. The stern moorings parted first. With the wind at S. E., and the tide running flood, the greatest strain would be on the stern in-shore chain. Three of the sâl posts to which the in-shore ships were moored broke off. The in-shore ship would be moored with her own cable, shackled on to the ring of the chain attached to this post. The order is that the ship's bower chains shall invariably be used. I do not believe that any ships were moored by their stream cables at the time of the gale. I am of opinion that it would be impossible to moor ships head and stern securely in mid stream; they must be moored head up the river during the freshes, and when the tide came in, they would certainly part their stern mooring chains. The eddies also would cause them to break adrift. Ships cannot be securely moored in this river head and stern unless where there is an easy tide-way. Moorings could be laid at Garden Reach on the eastern bank below the King of Oude's. Probably, 40 ships could be there moored. These would, however, all be without the present limits of the Port. To the northward of Calcutta, no more moorings could be laid; nor on the other side of the river on account of shallow water and the bore."

Mr. Peterson retires.

The Committee decide in requesting from the Marine Department the following:—

1*st.*—A plan of two tiers of moorings drawn to scale.

2*nd.*—A description of the moorings, shewing classes and number of each class and measurement of each class.

3*rd.*—A statement shewing sizes of ships put into the several classes of moorings, and copies of departmental orders (if any) which regulate that operation.

4*th.*—A statement shewing the date of laying down each mooring, the date of last examination, the extent of examination, and the official whose duty it was to make it.

5*th.*—A statement of the repairs (if any) which have been made during the last three years, and the failures which have occurred during that time.

6*th.*—Copy of the rules for the supervision and examination of the moorings.

7*th.*—And statement of the strength of the establishment for overhauling the fixed moorings, in boats and men, the time it takes to examine each mooring, and the number of moorings examined during the year.

The Committee adjourns for one week to allow time for preparation of these documents.

THIRD DAY.

WEDNESDAY, 9TH NOVEMBER 1864.

Members Present:

THE CHAIRMAN.
COLONEL A. FRASER, R. E.
CAPTAIN H. HOWE.

The President reports that Captain S. G. Boon has been appointed Secretary to the Committee by the Government of Bengal.

Read letter from the Secretary to the Committee, to the Master Attendant, requesting the returns specified in the minutes of the last Meeting.—(Appendix C.)

Read letter from the Harbour Master, to the Master Attendant, in reply.—(Appendix C.)

Resolved to resume consideration of these papers at the next Meeting.

Screw Moorings and Beacons. Wharves, Jetties, Tramways.

Laid on the Table. Three letters in manuscript from Colonel Fraser, R. E., to the Government of India, Public Works Department, referred to this Committee by the Government of Bengal, relating to Wharves, Jetties, and Tramway along the river bank.

Resolved that these letters be returned to the Government of Bengal, with a request that they may be printed, and copies furnished for the use of each Member of the Committee.

Screw Pile Light Houses and Beacons.

Read letter from the Secretary to the Government of Bengal, forwarding printed copies of a letter from Captain A. R. Weston, P. and O. S. S. *Simla*, recommending the substitution of Screw Pile Light Houses and Beacons in place of the Floating Light Vessels and Floating Buoys, now in use.—(Appendix D.)

Also docket from the Bengal Office, forwarding copy of a letter from Captain Weston, to Mr. Schiller, recommending that the same system of lighting and buoying should be adopted in the Mutlah.—(Appendix E.)

Resolved that consideration of these papers be resumed on receipt of the printed copies of Colonel Fraser's letters.

Resolved that the attendance of Captain Haddock, of the S. S. *Mauritius*, and of Mr. Behrends, Deputy Harbour Master, be requested before the Committee at its next Meeting.

The Committee adjourns at noon to Saturday, the 12th November, at 10-30.

FOURTH DAY.

SATURDAY, 12TH NOVEMBER 1864.

Members Present:

THE CHAIRMAN.
COLONEL A. FRASER, R. E.
CAPTAIN H. HYDE, R. E.
" H. HOWE.
MR. G. ROSS.

Read letter from Captain Howe, Deputy Master Attendant in charge, to the Secretary to the Government of Bengal, No. 2576, 24th October 1864, marked F. in the Appendix.

Read letter from Superintendent of Government Pier Works, Carwa, to the Secretary to Government of India, Marine Department, October 19th, 1864, marked G. in the Appendix.

Read Proceedings of the Sub-Committee, dated respectively 10th and 12th November, marked in the Appendix H., I.

CAPTAIN G. BARNES HADDOCK examined—

"I am Commander of the Screw Steamer *Mauritius*. This is my first year in command of the Steamer *Mauritius*, but I have been twelve years in command of vessels. The tonnage of my ship is 2,135 tons, length 265 feet, breadth 40 feet. I was in the Esplanade moorings, Nos. 9 and 10, during the gale of the 5th of October. The *Thunder* was astern of us. The *Govindpore* was ahead of me, outside her the *Beaumaris Castle*. My vessel was the inside one; the *Broughton Hall* was outside of me. I had been in the moorings about three weeks. My vessel was securely moored. I was moored head up the stream. The bow moorings were my own chains. The stern moorings on both sides belonged to the E I. Screw Steam Company. The best bower chain was used for the bow moorings. I had stern hawse pipes. I was not on board during the gale. The vessel broke adrift about 11 o'clock. I mean she parted her in-shore moorings about that time. The in-shore moorings are secured to posts. The wind at the time was E. N. E. That would be a little before the beam. The in-shore bow moorings gave way first. The vessel then fell on the top of the *Broughton Hall*; this was about 12 o'clock. The link of the in-shore stern moorings gave way on deck. In hauling in the chain of the in-shore bow mooring I found the shackle attached to it, nothing else. I hung by the stern moorings some time. While hanging on to the *Broughton Hall* the tier of shipping ahead gave way. There was sufficient scope on the remaining bower chain to allow the vessel to swing nearly across the tide. The *Mauritius* had her stern in-shore. My ship was the first of her tier to break adrift. The *Broughton Hall* and my ship left the moorings together. We drifted across the river together. My ship grounded first, the *Broughton Hall* a little after. We were close together after the gale. We dragged the starboard bower chain over with us and then slipped it. It was our own Company's chain that parted when the stern moorings gave way. The in-shore stern mooring parted, the other stern mooring we took over the other side where we slipped it. Our top-gallant yards were across and royal masts on end before and during the gale, but jib-boom rigged in. I don't think it would have made much difference if our top hamper had been down. I have some experience of screw moorings. I have ridden out a heavy gale at "Shields" without damage. There were no casualties of importance during that gale. The great advantage of screw moorings is their great holding power at any range and possibility of giving greater scope without sacrifice of room. The *Broughton Hall* was the only ship we fouled until we got over to the other side. It was nearly two hours from the time of parting the in-shore bower moorings until we broke adrift. I had no anchor ready to let go at the time of the gale. I would suggest that vessels during the hurricane months should have their bower anchor ready to let go, and should be required to do so by the Port Regulations. I have spare hawse pipes."

Witness retires.

MR. BEHRENDS examined—

"I am Deputy Harbour Master. I have held that appointment one year and ten months, but have been eight years in the Harbour Master's Department. It is part of my duty to examine the moorings. The examination commences about December. The buoy and ring to which the mooring chains are connected are hove-up. By heaving them up the whole is exposed to view, except the chain that is attached to the anchor. I mean to say that all the rings, shackles, and chains are examined and overhauled every year. Any defects discovered are invariably made good. No moorings defective in any particular are ever re-laid. During the last year the whole of the moorings were examined between December and April. What most commonly gives way are the fore-locks and shackles. Applications for moorings are made to the Harbour Master, and sometimes to me at Cooly Bazar. It is a standing rule that the largest and longest ships should be placed where the heaviest moorings are laid. Vessels moor with their bower cables fore and aft. Within the last two years I have never seen stream cables used. It is part of my duty to report it if I saw a stream cable used. I have recovered five anchors at Cooly Bazar moorings; of these two were backing anchors, the other three were first class anchors. They were in their places. I found the ring which attaches the bridle chain was carried away. We have not given up any moorings as lost. We have dragged for the whole of the moorings, but only those I have mentioned have been discovered. The only mooring anchor found out of its place as yet is one found at Cossipore, about 50 cwt., as near as I can say. The rings to which the bridle chains are attached gave way principally. The in-shore moorings at Cooly Bazar are made fast to sâl posts. Two of them were dragged out altogether. One of them was found under the bottom of the *Renown*. These posts appeared to be new. In No. 4 moorings the ships' in-shore chain gave way. I have recovered these chains. The *Sea Horse* carried away her timber heads. New moorings may be re-laid, if I had boats, men, and stores, in six months. It is not an uncommon thing for the rings to give way. The ship *Horizon* previous to the gale carried away the rings. Two or three months before the gale some ship carried away the rings in Garden Reach. I know nothing of the advantages of screw moorings. I don't think it would be safe to moor a ship in the stream by all fours during the freshes. I think in fine weather in the stream they may be moored head and stern."

Witness retires.

Committee adjourns to November 15th.

FIFTH DAY.

12TH NOVEMBER 1864.

Chairman and all the Members present.

Read statement marked K. in the Appendix.

CAPTAIN W. TATE, of the Ship *Broughton Hall*, examined—

"My vessel is 1,493 tons register, 225 feet in length, 40 feet beam. I was in Nos. 9 and 10 Esplanade moorings on the morning of the 5th October 1864. I had been there ten days. I was outside the *Mauritius* Steamer. The *Govindpore* and *Beaumaris Castle* were in the tier ahead of me, and the *Thunder* astern. We were moored head up the river. We were well moored. We were moored with our own chains. We had 15 fathoms on the bow chains from the hawse pipes. There were 30 fathoms on the stern moorings which gave 15 fathoms drift outside. The chain was two inches, it was our best bower chain. I had an anchor at the bows, but there was no chain bent to it. I had only one set of hawse pipes forward. The stern moorings passed through quarter hawse pipes. I had royal masts on end, but only top-gallant yards across, no sails bent, jib-boom rigged in. I was on board and so were my crew. The moorings first gave way about half past twelve, my port in-shore moorings first parted. The in-shore bow moorings of the Steamer *Mauritius* gave way a quarter of an hour before that, and she was lying on me. I am sure it was not my own chain that parted, because, when endeavoring to get afloat, I was obliged to slip it over the other side of the river finding it fast to something to which the cable of the *Mauritius* was also fast, and we were unable to heave it in. After the in-shore bow mooring parted the ship swung out as far as the other bow chain would permit; this parted in about an half hour. The ring to which my starboard cable was shackled, parted, in as much as my shackle was all right when the bow-cable was hove in. We then swung out into the river holding on to the stern moorings. We held on for a very short time, and then both stern moorings parted. My port hawse pipes and bitts were torn away, and the cable ran out. The starboard mooring parted within the hawse pipe. I don't think if we had let go an anchor we would have brought the vessel up. The wind was before the beam when we parted. It was flood tide when the cable gave way. Previous to *Mauritius* parting I did not observe we were bearing a heavy strain on the moorings of the *Mauritius*. I have had no experience in screw moorings. I think the present system of moorings may be improved. I think that bow and stern moorings alone, however strong, are not calculated to bear a heavy broadside strain, quarter moorings are required to keep a vessel in her place." Extract from the Log of the *Broughton Hall* is read and recorded.

Witness retires.

MR. ROBERT TAYLOR examined—

"I am the Commander of the *Newcastle*, 1,137 tons register, 196 feet in length, 36 feet 8 inches in breadth. We were in No. 4 Esplanade moorings on the 5th October 1864, and had been there about twenty-five days. We were fully loaded drawing 17 feet 4 inches. I was the inside ship of my tier. The *Winchester* was outside. I was moored head up stream. I considered my ship securely moored. We were moored with our own chains. I think 25 fathoms of our chain was out from the hawse pipes. The bower chain was used, its size was $1\frac{7}{8}$ inch. Both anchors were at the bows but no cable was bent. I have spare hawse pipes, but I can only use one set at a time on account of the patent windlass. I had royal yards across and sails bent ready for sea; jib-boom rigged in. My crew were all on board; I was not on board myself, all my Officers were. My moorings first gave way about 1-30 p. m. The ring of the in shore bow moorings first gave way. I found this out when I hove in the chain, and found the shackle attached to it uninjured. When the bow and in-shore mooring gave way I fell on top the *Winchester*. I then bent on the cable to the starboard anchor and let it go. The *Calumet* and *Clytemnestra* were in the tier ahead of the *Winchester* and myself, they fell across our bows. I then parted my other bow chain close to the hawse pipe. After this our stern chains parted, the in-shore moorings first gave way. The Government mooring gave way; I have the ring and about a dozen links, and a swivel. The timber heads gave way, and the other mooring ran out. The starboard bower anchor that had been let go parted at 90 fathoms. I have had no experience with screw moorings. I can make no suggestions to improve the present kind of moorings. In the Esplanade moorings the vessels appeared to lay very fair. I did not observe that any strain was brought on the in-shore moorings by the outside ship. I think the main topsail got adrift before the vessel broke from her moorings, the main trysail also got adrift."

Witness retires.

CAPTAIN J. ROBERTSON examined—

"I command the *Beaumaris Castle* of 1,040 tons, 202 feet in length, and 35-6 in breadth I was in No. 8 Esplanade moorings outside of my tier; the *Govindpore* was inside me; the *Broughton Hall* and *Mauritius* were astern; and the *Hampden* was the in-store ship ahead of us. I was moored head of the stream; my chains were crossed; our best bower cables were used, size $1\frac{3}{4}$ inch. We had both our anchors at the bows, no cables bent, we have only one set of hawse pipes. The stern moorings went through rolling chocks on the quarter. Our royal yards were across, no sails were bent. My ship is very stiff, stands up without ballast; I did not send down my royal yards, my experience in this river did not induce me to anticipate any gale or necessity for doing so. I had seventeen men on board, my full complement is 30 men; some of my crew were in hospital. I was on board during the gale, my Chief Officer was in hospital."

"About 11 o'clock the in-shore moorings of the *Mauritius* gave way, she fell on the *Broughton Hall*, and the weight of the two ships carried away our stern moorings leaving my stern cable and the *Govindpore's* shackled on to the bridle; about 11-30 the *Govindpore's* in-shore moorings gave way and she fell on me, we then slipped our stern chains to get clear of the *Govindpore* and swung head to wind; we remained in that way for about an half hour; then the *Hampden* and another ship above me came down on the top of us; the weight of these ships drove us out, we took the bow moorings with us. I can say positively that none of the ship's chains parted, for when I hove them up I found part of the Government moorings attached. I have had no experience with screw moorings. I would suggest that an anchor with a double shank and fluke to

each shank would stand better than the present plan of mooring. I think a 70 cwt. anchor ought to hold in a gale of wind in a river like this, I think the chain should be larger than 2 inches." Extract of ship's Log put in and read.

Witness retires.

Committee adjourns to the 23rd instant.

SIXTH DAY.

3RD NOVEMBER 1864.

Chairman and all the Members present.

Read statement of Sub-Committee marked L. in the Appendix.

Read the Harbour Master's report on the condition of the mooring posts and chains from Chandpaul Ghât to Armenian Ghât, marked M. in the Appendix.

MR. GEORGE GRIGS examined—

"I am the Commander of the *Moresfort*, of 1,184 tons, 230 feet in length, 34-4 beam. I was in No. 3 Calcutta moorings on the morning of the 5th October, the outside ship of my tier; next to me was the *Simla*; the in-shore vessel was the *Continental*. The *John Chisholm*, *Tornado*, *Dhollera*, and *Iron Duke* were in the tier astern. I was moored head up stream, and I believe well moored. I was in the moorings about five weeks. I was moored with my own cables fore and aft; size of chain 1⅞. Our chains were crossed. I had no chain bent to my anchor ready to let go while in moorings. There are spare hawse pipes, but our patent windlass prevents their being used. The stern chains lead through the quarters. Our royal masts were on end, and top-gallant yards crossed; no sails bent, and jib-boom rigged in. All the crew were on board, consisting of thirty, all told. I was on board during the Cyclone. At 11 A. M. the *Simla's* port bower chain gave way, she then fell on the top of us. My vessel held on about three quarters of an hour in this manner. The *Continental's* both stern moorings gave way and wedged the *Simla* upon us. In this position we remained an hour. The port bower chain then parted, it was the Government mooring chain that gave way. I found this to be the case when I hove the chain in and found a portion of the Government chain attached to it. The starboard chain parted half an hour after this; in this instance also it was the Government mooring chain that gave way, as I found some of the Government chain attached to my chain when I hove it in. All the time the starboard chain was holding us, the ships in the tier astern of me were dragging our stern outwards. Ultimately our stern moorings gave way; the fixed mooring chains parted. One of the mooring buoys we took away with us. I bent the port cable on the starboard anchor and dropped the anchor under foot when the first bower chain parted. My anchor brought me up for three quarters of an hour; I had 150 fathoms of chain out. I would have rode it out if three ships had not run into me. The ships were the *Solway*, *Red Rose*, and *Great Tasmania*. I think there would have been less damage if the ships had had there top hamper down before the Cyclone came on. As a nautical man, I thought the weather on the Tuesday evening (October 4th) threatening. I have commanded a ship in Calcutta three or four years. I was at anchor in the stream during the month of August of the present year for ten days. I am of opinion it would be perfectly feasible to moor ships head and stern in the stream; ships would be secure with the usual scope of 25 fathoms to the hawse. I have had experience with screw moorings. I have been at Newcastle-on-Tyne where screws are used. Their holding power is much greater. They will admit of longer scope. I have never known vessels to break adrift from screw moorings. The tide in the Tyne, when the ice breaks up, runs 7 knots. I have seen ships of two thousand tons lying two in a tier moored in the stream with that tide running. The ships were moored head and stern."

Question.—Are you aware that the object of putting ships into the moorings close to the shore is to keep them out of the strength of the tide?

Answer.—Certainly.

Question.—Did you sheer about much when riding in the stream during August last?

Answer.—A good deal.

Question.—Don't you think, with a tide running six or seven knots with flurries and eddies, it would be a dangerous position for a ship to be moored head and stern in the stream?

Answer.—That would depend upon how she was moored; if securely moored, I think they would not be so much in danger as ships lying at their own anchors in the stream.

Question.—Don't you think if she broke her sheer through any of the ground tackle giving way when moored head and stern in such a tide that she would be in danger of capsizing if she could not swing to the tide?

Answer.—No, not unless she took the ground.

A ship cannot break her sheer if moored head and stern. I think fixed moorings are preferable to swinging moorings in the stream.

Witness retires.

MR. GEORGE VIVIAN GIDEON examined—

'I command the *Winchester* of 1,157 tons, £10 feet long, 32 feet beam. I was in No. 4 Esplanade moorings, outside ship of my tier, *Newcastle* was inside of me, there was no vessel astern of us. I was moored head up stream and well moored. I was about 10 days in those moorings. I was moored with my own chains fore and aft. The bower chains were used, size 1⅞. I have double hawse pipes. I had an anchor and chain ready to let go. We had skysail masts aloft, top-gallant yards across, and jib-boom rigged in, no sails bent. The whole of my crew were on board, excepting 11 men discharged on the 4th, the day previous to the Cyclone. I was on board the day of the Cyclone. About 11 A. M. our starboard bower chain parted; our own chain parted. I was moored with open hawse. The *Newcastle* fell upon us before we parted. We remained some considerable time in this way, then the other bow chain parted, our own chain in this instance also gave way, we then hung by our stern moorings till 3 P. M.; the in-shore mooring at this time gave way; it was the Government chain that parted. I found this to be the case when I hove it in. The other stern mooring gave way when the *Thunder* fell upon us; the Government chain in this instance also gave way; in heaving my chain in I found the Government chain attached. I let go two anchors to bring the vessel up, one with the chain cable and one with a hemp cable bent to it; the weight of our anchors are 41 cwt.; we had 40 fathoms of chain out. The anchors did not bring the vessel up. I think the

vessels would not have felt the force of the wind so much if their top hamper had been down. I have been here before during the freshes. I have had no personal experience with screw moorings. Screw moorings, I believe, have greater holding power than common anchors. The vessels on the Tyne are moored, I understand, with bridles similar to the manner adopted in Calcutta; only that screws are used instead of anchors. In the freshes I would rather be at my own anchors than at all fours in the stream. I don't think vessels would be safe in fixed moorings in the stream during the freshes. I think the tides and eddies would make it unsafe. I think a ship would be safer lying at swinging mooring than at her own anchors."

Witness retires.

Committee adjourns to Monday, November 28th.

SEVENTH DAY.

28TH NOVEMBER 1864.

The Chairman and all the Members present.

Mr. GEORGE BARTLETT YOUNG, Branch Pilot, examined—

"I am of opinion that it is not safe to moor ships head and stern in the stream during the freshes. In the N. E. Monsoon, ships would be moored head down the stream. I think it would be more safe for a ship to be at swinging moorings than at her own anchors, provided the chain and anchors are larger than her own, and it would also be more convenient. The bore coming up would snap any chain; it is most felt on the Howrah side, and less felt in the centre of the stream than on either side of the river."

Question by the President, No. 1.—In which of the moorings is the bore most felt?

Answer.—In the Kidderpore and Bankshall moorings.

Question by Colonel Fraser, No. 2.—Would a vessel meeting a breaker be more jerked than by meeting a wave.?

Answer.—I think a vessel meeting a breaker would be more jerked than when meeting a wave.

Question by the President, No. 3.—Is the proportion of ships that break adrift from those moorings larger than any other?

Answer.—I am not able to say.

Question by Captain Hyde, No. 4.—Is the bore felt more or less in the stream opposite the Bankshall and Kidderpore moorings than in the moorings?

Answer.—I think more.

Question No. 5.—Is the bore felt more or less in the stream opposite the Esplanade moorings than in the moorings?

Answer.—More in the stream.

Question by Mr. Ross, No. 6.—Are there any parts of the river where the bore is less felt in the stream than at the Bankshall and Kidderpore moorings?

Answer.—There are parts.

Question No. 7.—What parts would you indicate?

Answer.—Above from where the bore crosses at Bankshall to Cossipore, also in Garden Reach.

Question No. 8.—Would there be much or any risk of a ship breaking her sheer well moored taught head and stern head up stream in the freshes?

Answer.—I think there would be a risk.

Question No. 9.—Would the strain then on the ships moored head and stern in the stream be so much greater than when lying at their own anchors?

Answer.—I think there is little difference, the ships' appliances are not strong enough to meet either case.

Question by Captain Howe, No. 10.—Supposing a ship moored head and stern in the stream during the freshes, and the ebb-tide running in eddies taking her on one bow and breaking her sheer, would not the ship be in danger of being thrown on her beam ends if unable to swing to the tide?

Answer.—Decidedly.

Question No. 11.—Would she be likely, under such circumstance, to carry away her cut water, stem, windlass, and hawse pipes, even if she were not thrown on her beam ends?

Answer.—If she got her chains under her fore foot which she would be likely to do in a bad sheer.

Witness withdraws.

Mr. GEORGE STREVENS examined—

"I am a pensioned Branch Pilot."

Question by the President, No. 12.—How many years' experience have you had on the river?

Answer.—I have had 41 years' experience on active service.

Question No. 13.—Do you think it would be safe to moor vessels head and stern in the stream all through the year?

Answer.—I do not.

Question No. 14.—Do you think it would be safe to moor vessels in this way during any part of the year?

Answer.—It may be for two or three months during the easy tides.

Question No. 15.—Why do you think vessels could not be safely moored at all fours during the other months of the year?

Answer.—During the freshes eddies are very violent, the sands shift, and the bore is very strong.

Question No. 16.—Is the bore strongest in the stream where ships are anchored, or on the side of the river on the east bank where they are moored?

Answer.—It would be strongest in the stream.

Question No. 17.—Are there parts of the river where the bore is more felt in the stream than at other parts?

Answer.—I think not, all the way up in deep water it is felt the same.

Question No. 18.—Does the bore cross the river at any particular parts?

Answer.—Yes, it crosses from Howrah Ghaut to near Mint Ghaut, and from thence it crosses to the Goosery side.

Question No. 19.—At these crossing points is the bore felt more strongly than at other parts of the stream?

Answer.—I think not.

Question by Captain Howe, No. 20.—You say the bore crosses first from Howrah over to the Mint, but the wave pervades the whole river, does it not?

Answer—Certainly.

Question No. 21.—Is the bore felt more or less in the stream opposite Kidderpore and Bankshall mooring than in the moorings?

Answer.—I think more.

Question No. 22.—Is the bore felt more or less in the stream opposite the Esplande than in the Esplanade moorings?

Answer.—More in the stream.

Question by Colonel Fraser, No. 23.—You said if nothing gave way, ships would not sheer to a dangerous extent; do you think that it is possible to moor ships in mid stream sufficiently strong that nothing should give way in moorings or ships?

Answer.—The moorings might be made of sufficient strength, but the ships as they exist, according to my experience, have not sufficiently strong fittings to bear the strain.

Question by Mr. Ross, No. 24.—Would there be much or any risk of a ship breaking her sheer well-moored taught head and stern head up stream on the freshes?

Answer.—If she was well-moored she would not have scope sufficient to allow her to sheer more than a point, and that would not be sufficient to lead to damage to the vessel.

Question by Captain Howe, No. 25.—Do you think cargo or other boats could go alongside ships moored in the stream during the height of the freshes?

Answer.—I think not.

Question by the President, No. 26.—In your long experience have you ever known ships moored head and stern in the stream during the freshes?

Answer.—No.

Adjourned to 1st December.

EIGHTH DAY.

1ST DECEMBER.

All the Members present.

MR. JAMES FREDERICK PETERSON, Harbour Master, re-called and examined.

Question by the President, No. 27.—Have you, in your long experience of Harbour Master, ever seen ships moored in the stream at all fours?

Answer.—No.

Question No. 28.—Do you think they could be safely moored in that way?

Answer.—No.

Question No. 29.—Not at any season of the year?

Answer.—For three months, from November to February, they could be safely so moored.

Question No. 30.—Then during the other nine months you think they could not be so moored?

Answer.—They could not.

Question No. 31.—Why not?

Answer.—On account of the strong tides and bores.

Question No. 32.—What effect would the strong tides, which you allude to, have on vessels moored at all fours in the stream?

Answer.—If they take the slightest "cant" every thing will be carried away.

Question No. 33.—What do you mean "every thing will be carried away?"

Answer.—Either the ship's chains, bitts, or mooring chains would part.

Question No. 34.—Cannot ships be so moored that they may ride fair to the tide, and such a case as you describe be rendered impossible?

Answer.—No, there must be some slack chain to allow of the rise and fall of tide.

Question No. 35.—Have you had any practical experience of mooring in other Ports?

Answer.—No.

Question by Colonel Fraser, No. 36.—You say ships cannot be safely moored at all fours in the centre of the stream—are there any other positions within the limits of the Port besides eastern bank where ships could be so moored?

Answer.—None, excepting the four moorings laid abreast of the Salt Golahs.

Question No. 37.—Is there room for additional moorings abreast of the Salt Golahs?

Answer.—No.

Question by Mr. Ross, No. 38.—In some of the outside moorings, for instance, the four berth tiers, are not the tides, eddies, and bores as strong, or nearly so, as in the middle of the stream?

Answer.—Not quite so strong as in the middle of the river.

Question No. 39.—Are they nearly so strong?

Answer.—They may be nearly as strong.

Question No. 40.—You say the tides, eddies, and bores are felt nearly as strong by vessels lying in the outside tier in some of the Calcutta Moorings, as by vessels in the stream—have any of the consequences you predict as likely to occur to vessel moored in the stream, occurred to vessels in such berths?

Answer.—No, the in-shore ship is the key of her tier, and we are always compelled when we move a ship out from the in-shore berth, to have another vessel ready to go in; this keeps vessels in the tier from sheering.

Question No. 41.—Must not the ships in the moorings have play on their mooring tackle, and so the outside ship be at liberty to cant in like manner as if they were at all fours in the stream?

Answer.—No, the outside ship is checked by the vessels inside her, and so she cannot sheer about, as she would, if moored singly in the stream.

Question by Colonel Fraser, No. 42.—Would the strain upon the tackle of a ship moored at all fours in the stream be more or less in the freshes than if she were at liberty to sheer about at her own anchors?

Answer.—The strain would be greater if she were moored under fours.

Question by Captain Hyde, No. 43.—Is the force of the tide and eddies, and of the bores, as strong in any of the moorings on the Calcutta side as in the centre of the stream?

Answer.—The tides and eddies are nearly as bad in the two outer berths Nos. 1 and 2, Calcutta moorings, but not quite; the bores are less felt.

Question by Captain Howe, No. 44.—Independent of the action of the tide on a ship moored head and stern in the stream in the freshes, as suggested in previous questions, would not the occurrence of a heavy gale of wind blowing on the broad side of a ship in such circumstances place her in danger if she could not swing or ride head to wind?

Answer.—It would be dangerous for her.

Question by the President, No. 45.—Is there any spot in the centre of the stream within Port limits where the tide and bores, separately for each, are less felt than in Nos. 1 and 2, Calcutta Moorings?

Answer.—As to tide, none; as to bore, I don't know of any.

Question by Captain Hyde, No 46.—In what parts of the river are the bores most felt, I mean

whether in the stream or in-shore where the ships lie at moorings?

Answer.—The bore is strongest on the western bank and up to the centre of the stream; from the centre to the eastern bank it is less felt.

Question by Captain Howe, No. 47.—Is the bore in the centre of the stream more felt than in the moorings on the Calcutta side?

Answer.—Yes, a great deal.

Witness withdraws.

Mr. C. W. Warden, Branch Pilot, examined.

Question by the President, No. 48.—What experience have you had of this river?

Answer.—I have been 27 years in the service.

Question No. 49.—Have you, in your experience, ever seen ships moored under fours in the stream?

Answer.—Never.

Question No. 50.—Do you think they could be safely so moored?

Answer.—I am unable to give a positive opinion.

Question No. 51.—Do you wish that answer to be understood to apply to all seasons of the year?

Answer.—I think at some season of the year they could be so moored.

Question No. 52.—What season?

Answer.—From November to March inclusive.

Question No. 53.—Then as to the other months?

Answer.—No, I think it would not be safe.

Question No. 54.—Why not?

Answer.—On account of the tides and the communication with the shore for cargo and passengers.

Question No. 55.—How could the tide affect the ship so moored?

Answer.—The tides at certain seasons of the year do not run fair; they run in surfaces in opposite directions, they cause a ship to run ahead of her anchors, to sheer and to carry away her chains, hawse pipes, and other gear.

Question by Mr. Ross, No. 56.—That remark applies to vessels lying at their own anchors, but if moored under fours they could not run ahead of their anchors?

Answer.—If they were so moored, head and stern, that they could not move, then of course they could not run ahead of their anchors.

Question No. 57.—Is it possible to moor a ship in that way?

Answer.—I hardly think it is.

Question by the President, No. 58.—But why not?

Answer.—Because you must allow some latitude for rise and fall of tide.

Question No. 59.—Have you had any experience of moorings in other Ports?

Answer.—I have not.

Question No. 60.—Supposing fixed moorings are laid in the stream of such weight that they could not be lifted, with cable of extra strength, so that nothing could give way; do you then think that ships could be safely moored in the stream?

Answer.—I don't think the appliances of ship suitable for such moorings.

Question by Mr. Ross, No. 61.—Given the same appliances, would the ship be more safe in the stream at her own anchors swinging to the tide than at her fixed moorings?

Answer.—Moorings in the stream under fours are safer.

Question No. 62.—If you were taking a ship, say, a heavy ship, to sea in the freshes, and on coming to your anchorage for the day, found you could put her into fixed moorings, all fours in the streams, would you do so, or would you prefer to keep her at her own anchors?

Answer.—I would put her into moorings so far as the safety of the ship is concerned.

Question by the President, No. 63.—You have said already that ships cannot be safely moored under fours in the stream during the freshes, yet you now say they would be safer moored than riding at their own anchors; how do you reconcile these answers to the fact that vessels do ride safely at their own anchors in the stream?

Answer.—It is not safe for ships lying either at their own anchors or at moorings in the stream, but of the two they are safer at fixed moorings.

Question by Captain Howe, No. 64.—Is it possible to moor under fours, so that a vessel should not sheer about to a certain extent?

Answer.—It may be possible at slack water.

Question No. 65.—Supposing her so moored, what would be the effect of an eddy tide acting on the bow or quarter?

Answer.—It might careen her a little over, but beyond that no harm would ensue.

Question by Captain Howe, No. 66.—What would be the effect of a gale of wind on the beam of a ship so moored?

Answer.—If light, she might turn over; if laden, she would ride safely.

Question by Mr. Ross, No. 67.—Supposing a vessel in the in-shore moorings with a similar gale of wind, what would be the effect?

Answer.—The effect would be similar.

Committee adjourns to December 3rd.

NINTH DAY.

3rd December.

All the Members present.

Mr. W. H. Cox, Branch Pilot, examined.

Question by the President, No. 60—What experience have you had of the river?

Answer.—Nearly 22 years' continuous service.

Question No. 61.—In that long experience, have you yourself moored ship under fours in the stream, or seen a ship so moored?

Answer.—Never.

Question No 62.—Do you think it could be safely so done at any season?

Answer.—I certainly do not think it could be done during the freshes.

Question No. 63.—Why not in the S. W. Monsoon?

Answer.—I think ships would be injured, though they might not part from their moorings, owing to the strength of the tides.

Question No. 64.—Supposing no moorings near the river bank to be available, and that it was necessary for the vessel to remain in the stream, do you think she would be safer at her own anchors, swinging to the ebb and flood, than moored in the stream head and stern to fixed moorings?

Answer.—Lying in the stream head and stern, he would have four chains to break before she

went adrift, lying at her own moorings she would have only two, consequently she would be safer at fixed moorings.

Question by Colonel Fraser, No. 65.—If in fixed moorings one of the ship's bow chains parted, would there be any liability of her capsizing, a strong tide running?

Answer.—She would careen over, but if a good model, there would not be much chance of her capsizing.

Question by Captain Howe, No. 66.—You say a ship would have four chains to carry away before she broke adrift; but she would only have two at each extremity at a time?

Answer.—Yes.

Question No. 67.—Head up the river, if a vessel parted her bow chains and swinging round till brought up by her stern moorings, would she be likely to hold on riding stern on to a strong ebb tide in the freshes?

Answer.—That entirely depends on the strength of the stern fastenings of the ship.

Question by Captain Howe, No. 68.—Would it not also depend somewhat on the form of a ship, thus, would a ship ride by the stern so securely, or nearly so, as by the head?

Answer.—The stern frame of a ship is not calculated to hold her

Question by the President, No. 69—Has the helm any power over the vessel in a tide way when fast by the stern?

Answer.—I think not.

Question No. 70.—Then would the ship so fast not sheer about to a dangerous extent, and be liable at once to carry away her stern moorings?

Answer.—The liability to do so increases.

Question by Captain Howe, No. 71.—Should a ship be moored in the stream under fours, could she by means of her helm sheer out of the way of any danger coming upon her, say a ship or straw boat on fire, or vessel adrift?

Answer.—She could not.

Question by the President, No. 72.—Then as to swinging moorings, would these be safer for vessels than lying at their own anchors, swinging ebb and flood?

Answer.—They would be safer.

Question No. 73.—I put these three positions to you,—

A vessel off town with no mooring berth vacant near the shore, in which position do you think she would be most safe?

1*st.*—Riding at her own anchors, swinging ebb and flood.

2*nd.*—Riding at Government swinging moorings.

3*rd*—Moored at fixed moorings under fours.

Answer.—I certainly think the second, whilst riding at Government swinging moorings she would have her two anchors ready to let go in case of accident.

Question No. 74.—Are there any of the parts of the river within the limits of the Port beyond those now laid with moorings where moorings could be laid?

Answer.—I think there are from Muttea Bruss's Ghaut to the premises of the Calcutta Steam Tug Company; ships could be moored near the bank, and I think twenty ships could be moored near the bank in double tiers, but this is outside the present limits of the port: again on the right bank from the Garden House Point to the Garden Steps six ships could be moored in a single tier; above Muttea Bruss's Ghaut, three more in single tier.

Question No. 75.—Is the force of the bore where it is most felt in the moorings greater or less than where least felt in the river?

Answer.—I think about the same.

Question No. 76.—Where is it least felt in the stream?

Answer.—Abreast of Fort Point.

Question No. 77.—Where is it most felt in the moorings?

Answer.—Bankshall Ghaut.

Witness retires.

Mr. B. K. Benesly, Brevet, B. P., examined.

Has been 21 years' continuous service on the river, part of which time was spent in the Surveying Department.

Question by the President, No. 78.—In that long experience have you yourself moored vessels under fours in the stream or seen a ship so moored?

Answer.—Never.

Question No. 79.—Do you think it could safely be done at any season?

Answer.—I don't think it could with safety to herself during the period when bores prevail, or during the height of the freshes.

Question No. 80.—Why not in the S. W. Monsoon.

Answer.—I think she could not be safely so moored, because you must allow a certain amount of scope, and she would either forge ahead into the next tier or something would give way on board: a ship's fastenings are not calculated to hold in such a heavy stream, particularly the stern fastenings, and this is where the greatest strain would be, the increased strain on a ship moored head up stream as she would necessarily be during the freshes.

Question No. 81.—I put these three positions to you—A vessel off town with no mooring berth vacant near the shore, in which position do you think she would be most safe?

1*st.*—Riding at her own anchors, swinging ebb and flood.

2*nd.*—Riding at Government swinging moorings.

3*rd.*—Moored at fixed moorings under fours.

Answer.—I think the second, for the same reason as Mr. W. Cox. Riding at ship's anchors or being moored under fours, I think the latter would be the least dangerous of the two.

Question No. 82.—Are there any other parts of the river within the limits of the Port beyond those now laid with moorings where moorings could be laid?

Answer.—None within the limits of the Port. In Garden Reach from Muttea Bruss's Ghaut to Gordon, Stuart and Co., I think ships could be moored in three tiers without inconveniencing the running channel on the northern bank, perhaps 16 ships in single tier, but the present "turning ground" must be abandoned.

Question No. 83.—Do you think the strain on the ship's appliances would be greater or less when riding at her own anchors, or when moored at all fours?

Answer.—The strain will be greater if riding at her own anchors and sheering about.

Witness withdraws.

Committee adjourns to December 10th.

TENTH DAY.

10TH DECEMBER 1864.

All the Members present.

MR. CHARLES SMYTH, Master Pilot, examined.

Question by the President, No. 84.—How long have you been in the service?

Answer.—I have been in the service 21 years; my service has been continuous.

Question No. 85.—Have you had any experience of mooring vessels under fours in the stream?

Answer.—None.

Question No. 86.—Have you ever seen vessels so moored?

Answer.—No.

Question No. 87.—Do you think they could be so moored with safety to the vessels themselves?

Answer.—As ships are generally fitted, especially their after-fittings, I think they could not be so moored.

Question No. 88.—In the N. E. Monsoon?

Answer.—I think that from the 15th November to the end of January inclusive they could be so moored in safety.

Question No. 89.—In the S. W. Monsoon?

Answer.—No.

Question No. 90.—Have you ever seen vessels in the stream moored to permanent swinging moorings?

Answer.—Yes.

Question No. 91.—Do you consider a vessel at such moorings safer than lying at her own anchors in the stream?

Answer—Yes.

Question No. 92.—On what grounds?

Answer.—The anchor being heavier, has a greater holding power; the ground tackle can be made heavier and stronger than a ship's ground tackle would be; she would also have her own anchors ready to let go if she broke adrift.

Question No. 93.—Vessels moored under fours require, I presume, less space than if moored to swinging moorings or lying at their own anchors?

Answer.—They would.

Question No. 94.—Then in the N. E. Monsoon, when you think that vessels could safely be moored under fours, by so mooring them, many more vessels could be accommodated within limits of the Port than swinging ebb and flood, can you form an idea how many additional vessels could be so accommodated, say between Hastings' Bridge and abreast the Railway Ghaut?

Answer—I cannot say how many, but I should think fully double the number which can now be accommodated.

Question No. 95—In the S. W. Monsoon, presuming no in-shore mooring available, which of the three methods of mooring would you prefer?

1*st.*—At fixed moorings under fours in the stream.

2*nd.*—At permanent swinging moorings.

3*rd.*—At her own anchors?

Answer.—I think the second.

Question by Colonel Fraser, No. 96.—Could the moorings be so laid in the stream that in the N. E. Monsoon when the river is most crowded they could be converted into swinging moorings?

Answer.—Yes they could be so laid; but of course the same number of vessels could not be put into them when used as swinging moorings.

Question No. 97.—You have said that of the methods of mooring a ship in the stream in the S. W. Monsoon when no in-shore moorings were available, a vessel would be safer at permanent swinging moorings than if moored under fours, or lying at her own anchors; but a vessel lying at her own anchors, and one moored under fours, which would you consider the safest for the vessel?

Answer.—I would prefer my own anchors.

Witness withdraws.

MR. CHARLES REED JOHNSON, Commander of the *Continental,* British Ship, examined.

Question by the President, No. 98.—Have you been frequently to this Port?

Answer.—I have been here six or seven times, since 1850, at all seasons of the year. I have had experience of the strength of the freshes as much as most ship masters.

Question No. 99.—Supposing you arrived off town and found no mooring berth available in shore and were offered the choice of mooring your vessel in the stream in three ways, *viz.*:—

1*st.*—At fixed moorings under fours,

2*nd*—At permanent swinging moorings,

3*rd.*—At your own anchors,

Which do you think would be the safest for your vessel?

Answer.—I would prefer lying at my own anchors.

Question No. 100.—Why?

Answer.—Because, through eddies or the bore, the ship would be likely to run over the buoy (at swinging moorings) and be in danger of rubbing off her copper, or even stave in a plank.

Question No. 101.—Are there no means of keeping the buoy clear of the ship?

Answer.—It could be done by leading a hawser from the buoy to the bowsprit; but that would bring a heavier strain on the bowsprit than I should consider safe.

Question by Colonel Fraser, No. 102.—You say ships at swinging moorings would forge a head foul of the buoy, is that not an argument in favor of all fours?

Answer.—Yes, but although many ships are properly fitted to receive the after chains, many are not.

Question by Captain Howe, No. 103.—Do you think that a ship moored head and stern in the stream during heavy freshes would be in a safer position even if she had bitts strong enough to hold her aft?

Answer.—Yes, I think she would.

Question No. 104.—Would she not be safer if able to swing to the tide instead of having to bear a heavy lateral pressure with strong eddies and flurries?

Answer.—Yes.

Question No. 105.—Would not a ship moored head and stern in the stream be in a dangerous position with a heavy gale of wind on her beam, she being unable to swing or ride head to wind?

Answer.—She would, if her ports were not properly secured.

Question by Colonel Fraser, No. 106.—Would the danger be greater or less than if in moorings near the bank?

Answer.—If the wind was off shore she would be safer in the shore moorings; if on the other beam she would be safer in the stream.

Question No. 107.—You have had considerable experience of the Mississippi?

Answer.—I have been there half a dozen times.

Question No. 108.—Is there any similarity between that river and the Hooghly?

Answer.—The only difference between the Hooghly and the Mississippi is that the stream always runs down in the Mississippi; there is no flow of tide.

Question No. 109.—What is the velocity of the river in the strongest tides?

Answer.—I should think 8 knots, quite as strong as in the Hooghly in the freshes.

Question No. 110.—How are ships moored in the Mississippi?

Answer.—They lay alongside the Pier usually 3 in a tier, moored head and stern all head up stream; every ship in each tier has her own bow and stern hawsers made fast to posts on shore; the largest ships are usually put outside, no anchor moorings are provided: it is optional for any ship to let go her anchor if she likes; ships are made fast to each tier; the inside ship is the key ship, she is supposed to be so well secured that she can hold the outside vessels: the wharps of the key ship are fast to the Pier: every ship lies with her yards a cock-bill.

Question No. 111.—Is the stream of the Mississippi alongside the Pier as strong as in the Hooghly in the moorings?

Answer.—Equally as strong.

Question by the President, No. 112.—Have you ever rode out a gale of wind in the Mississippi moored as you described?

Answer.—Not a heavy gale.

Question No. 113.—Do you consider the mode of mooring ships in the Mississppi superior in point of safety to the method adopted in this river?

Answer.—If each ship has her own anchor, as each vessel in the Mississppi has her own post, they ought to hold equally well; but if they do break adrift they are better off in the Mississippi than here, because they have their own anchors ready to let go.

Question No. 114.—Do you think ships moored in the Mississippi as you have described could have rode out in safety the gale of the 5th October 1864?

Answer.—I don't think they would.

Question No. 115.—Are the Piers in the Mississippi public or private property?

Answer.—Private property.

Question No. 116.—Are they substantially erected?

Answer.—No.

Question No. 117.—How do they fare in a gale of wind?

Answer.—They have a post or two knocked away occasionally, but I never saw any carried away altogether.

Question No. 118.—In what length of time is a vessel usually loaded and discharged, say of 1,000 tons.?

Answer.—They can discharge and load in fifteen days at the outside.

Question No. 119.—Do vessels anchor in the stream in the Mississippi?

Answer.—They do, until they can get a berth.

Question No. 120.—Are accidents to vessels in the stream as frequent as here?

Answer.—No, a ship very rarely sustains any damage.

Witness withdraws.

Committee adjourns to December 16th.

REPORT.

The Committee appointed by His Honor the Lieutenant-Governor of Bengal to enquire into the system of Moorings existing in the Port of Calcutta, and the desirableness of substituting Screw Moorings for those heretofore in use, and to whom the following further subjects were subsequently remitted for their consideration, *viz.*:—

"A plan for increasing the conveniences of the Port by the constructions of Quays, Jetties, and Tramways;

"A proposition to substitute Screw Pile Lighthouses for the Light Vessels at the Sandheads; and

"A similar proposition for the substitution of Screw Pile Beacons for the Channel Buoys;"

—having taken evidence, oral and documentary, as printed in detail in the Appendix hereof, have the honor to report—

See letter of instructions, Appendix A.

1*st*.—ON THE CALCUTTA MOORINGS.

The Committee find from the Marine Office that, prior to the Cyclone of 5th October last, the most violent storm of which there is any definite record as passing over the Port of Calcutta was that of the 3rd June 1842, and that on that date the state of the moorings is recorded to have been as follows:— Appendix W.

Fixed Moorings along shore	59
Swinging Moorings in stream	32

In the fixed moorings 5 ships rode safely during the storm and 32 broke adrift; the other moorings were vacant.

In the swinging moorings 21 remained secure and 11 were carried away.

The Reports of the gale state that of the 32 casualties in the fixed moorings

25 ships parted in the shackles,
3 ships parted bridle chains,
1 ship parted from shore post,
3 ships, there is no report.

The whole of the moorings could not be recovered immediately after the storm, and hence many ships had to ride at their own anchors in the stream during the freshes, and a report (Appendix X.) shews that among these ships between the 14th July and 27th August there were 40 casualties of various kinds.

In the commencement of 1855 the fixed moorings were increased so as to accommodate 77 vessels, and the Chamber of Commerce, finding that this was still insufficient, suggested that swinging moorings should be laid down.

The Marine Authorities strongly objected to this, and Captain Rogers, then Superintendent of Marine, in urging wet docks, pointed out that if a violent storm did pass over the crowded Port of Calcutta in the freshes "the destruction of property and life would be immense."

Later in the same year Government sanctioned an increase in the fixed moorings so as to accommodate 154 ships, and the moorings have been added to till in the month of October, prior to the Cyclone, the Committee find that the mooorings in Port numbered 174 as per plan and detailed sketch.

The Committee find that the moorings have been yearly examined, overhauled, and reported on by the Harbour Master, as per Appendix C., under written orders from the Master Attendant issued from time to time.

The evidence shews that the moorings are divided into three classes as follows:—

1st Class Moorings for ships of 1,200 tons and upwards.

2nd Class Moorings for ships of 700 tons and upwards.

3rd Class Moorings for small ships of 300 tons and for river craft.

Special moorings had to be put down for the ships of the East Indian and London Screw Steam Shipping Company, the length of their ships exceeding that of the largest vessels usually resorting to this Port.

The moorings were laid with single fluke anchors. The whole of the tackle below the rings, together with buoys and their connecting chains, belonged to the Port.

Vessels were moored under the Harbour Master's orders by their own bower cables to the rings.

Harbour Masters were responsible for the work of mooring.

The Committee find, from the records of the Master Attendant's Office, that there were in moorings on the morning of the 5th October last 151 vessels, of which 144 drifted or were carried away.

The Committee find that during the Cyclone the in-shore tackle generally first gave way, and that the reasons for this appear to have been—

1*st*.—That from the course in which the Cyclone passed over the vessels moored, the greatest strain was brought on the shore tackle.

2*ndly*.—That the system of mooring adopted transmitted to the shore tackle an undue strain, (*viz*., a portion of the tension caused by every ship in the tier in addition to the tension due to the ships directly moored by it,) whilst this tackle was only of ordinary size as compared with other portions of the moorings.

3*rdly*.—That the system of mooring adopted in the port was so far defective in that every ship in a tier or set of tiers was more or less dependent on the other ships. That the vessels being thus as it were links of a floating net work, any one link of which giving way, or any portion of ships mooring or tackle failing, the whole fabric was of necessity disturbed; so that in the late Cyclone, when portions did give way, an accumulated strain was brought on link after link, on mooring after mooring, till the whole of the ships went adrift together.

Captain Howe is of opinion that, before condemning the present system as defective, the Committee are bound to shew that a better system is in existence elsewhere, or to propose a more perfect system for this Port. The majority of the Committee are, however, of opinion that it is only necessary they should point out what they believe to have been the causes of failure of the present system, leaving it to the professional advisers of the Government to provide the remedy.

The Committee find that in the year 1842 the average burthen of ships was 550 tons, while in 1864 it was 850 tons.

The Committee find from the detailed evidence of the failure in the moorings that most frequently the failure has been in the Government moorings.

1*st*.—That though the storm of June 1842, when the largest anchors laid were of 60 cwt., and all previous experience justified the belief that the anchors actually in use, ranging from 60 to 70 cwt., were sufficient, yet the Cyclone of 5th October 1864 has proved that the largest anchors used were insufficient for the purposes of the Port, having regard to the increased size of ships now to be provided for.

2*nd*.—That the almost universal faultiness in the shackles as shewn in the gale of 1842 has been in a measure remedied; but that mooring rings of large diameter, such as were in use, though of great massiveness and apparent strength, were ill calculated to bear excessive strain, and consequently gave way.

3*rd*.—That there have also been failures in the fittings and tackles of the ships.

4*th*.—That many ships trading to this Port are not constructed to meet the requirements of mooring in the River Hooghly, which for safety demands double hawse pipes forward and hawse pipes aft. Appendix B., G., S.

5*th*.—That though there are printed regulations for the shipping, as per Appendix Y. generally, ships were not prepared for the Cyclone, and that there were no means in the Port of giving warning of approaching storms.

The Committee have before them several letters and pamphlets on screw moorings; they also have evidence of screw moorings being laid in other Ports. It appears to the Committee that the general system on which these screw moorings are laid down is correct, and that the holding power of screw moorings is limited only by the strength of tackle. They, therefore, recommend that the whole of the Calcutta Moorings be relaid with screw moorings, and that these moorings be obtained, as advised in the preliminary Report.* * Appendix R.

They also recommend that the attention of the Home Authorities be directed to Saunder's patent safety springs, as that plan seems intended to provide against one of the greatest and most frequent causes of injury to which vessels moored in this Port are subject, *viz*., sudden and violent jerks.

They recommend that intimation be given to Lloyds, and generally, so far as may be possible, to ship-owners that the safety of ships in the River Hooghly would be greatly promoted by the ships being provided with hawse pipes aft to carry mooring chains, and of double hawse pipes forward to admit of mooring chains being attached without unbending the cables from the anchors, so that the anchors should always be available for immediate use in the Port.

The Committee recommend that, in connection with Light-houses, the Coast Telegraph and the Calcutta Observatory, a comprehensive system of weather observations and warnings, be organized after the plan of Admiral Fitzroy, which has been carried out throughout Great Britain, and they would urge on Government not to take any half measure from means available in this country, but to at once apply to the proper authorities in England for a complete system, and that thereon rules and regulations for the shipping in the Port be printed and issued.

The Committee, finding that the number of mooring berths was not sufficient to contain the shippping of the Port, took evidence as to the possibility of extending the moorings, or of otherwise providing safely for vessels which cannot be moored along the river bank.

They find that the moorings proper cannot be sufficiently extended in the Port.

That therefore ships must of necessity ride in the stream.

That ships would not be safe at fixed moorings in the stream.

That swinging at their own anchors, ships are not safe in the S. W. Monsoon.

That if it be absolutely necessary to place ships in the stream during the S. W. Monsoon, the best method of placing them will be at swinging screw moorings.

These conclusions are fully borne out, as well by the evidence taken by the Committee, as by the the records of the casualties which occurred in the river during the freshes of 1842, and by the experience of the Marine Department from that date to 1855.

Appendix XD.

The Committee, therefore, recommend that such moorings be placed in the river, not as affording a safe berth (for the Committee do not consider a ship safe in any portion of the stream during the S. W. Monsoon), but as the best alternative for a ship that cannot get a shore berth.

Finally, the Committee strongly recommend that a steam anchor boat with steam windlass or other appliance be provided as early as possible for the the service of the Port. There is urgent need for a boat of this character, which can be moved with facility from point to point, both in connection with the moorings and for recovering ships' anchors with greater expedition than is at present possible.

2nd.—SCREW PILE JETTIES.

It is in evidence before the Committee that moorings have been put down in every spot where it is safe to place a ship throughout the year.

That though trials have been made by placing moorings in other spots where the depth of water permitted, it has been found that there is no safe mooring ground unoccupied, and that the moorings cannot be extended within the Port, and it is conclusively shewn that there is not room for the vessels now resorting to Calcutta to remain in the Port during the S. W. Monsoon in safety.

The Committee consider it imperative that every possible step should be taken to give proper and sufficient accommodation to the shipping, and they point out that, in their opinion, the first and immediate step is the construction of jetties.

It is in evidence that in loading and unloading from jetties there will be a great saving in time, and consequently, with a given trade, a diminution of the number of ships at any one time in the Port. The advantages of jetties to ships, shippers, and the Customs Department, are so well recognized as to need no notice from the Committee.

The Committee consider that some approved plan of jetties should at once be adopted; they strongly urge that no more time be lost, that immediate action be taken, and that no scheme of wet docks be permitted to delay the construction of jetties, the object of which being to give immediate as well as permanent relief to existing trade can in no way affect any scheme that will take time to mature, execute, and bring into operation.

The Committee point out that, however much the Port may be assisted, that however rapidly any docks may hereafter be built and extended, the accommodation will for years have difficulty in keeping pace with the wants of trade, and that there will be sufficient shipping to occupy Jetties as well as Wet Docks.

The Committee have before them Colonel Fraser's letter with enclosures, and though the Committee cannot give any opinion on the construction, they can acknowledge to a certain extent the efficiency and adaptability of screw pile jetties to the Port of Calcutta, and they therefore recommend the consideration of the scheme to Government, pointing out that to the Committee one of the greatest advantages of the plan is rapidity of construction.

Appendix S.

3rd.—SCREW PILE LIGHT HOUSES.

The Committee have evidence before them that, in the case of a severe gale, the floating lights are almost invariably driven from their stations; that in ordinary weather some of these vessels are often drifted long distances, and that, in short, the lights when most required are gone or are uncertain in position. The Committee consider, therefore, that, if it be possible to establish fixed lights at the mouth of the Hooghly, lights should be so fixed, and though they consider that the urgency for the best possible lights is sufficient to warrant a very large outlay, they are of opinion that if it be found practicable to establish screw pile light-houses, such structures will be found less costly than the light ships both in first construction and after maintenance. The question of construction appears to the Committee to be a purely professional one; they therefore confine themselves to advising and urging Government to direct proper surveys and experiments to be made by their Light-house Engineer, sufficient to determine the practicability of placing the most approved Light-houses on the Sands at the mouth of the Hooghly. The Committee point

Appendix W.

out that the experiment will not be one as to construction but as to fitness of locality to receive structures of known excellence, and that the importance of the object to be attained will warrant considerable outlay.

4th.—SCREW BEACONS IN THE RIVER.

The Committee find that the buoys as moored are constantly carried adrift, and they advise, as in the case of Light-houses and for similar reasons, that experimental screw pile beacons be at once put in settled parts of the river. Such beacons, if found to succeed, would be found very serviceable as tidal gauges.

Colonel Fraser, R. E., a Member of the Committee, having left Calcutta before this Report was drawn up, his signature is not attached to it. The Committee, however, believe that he fully coincides with the conclusions and recommendations expressed herein.

JOHN N. BULLEN,
President.

H. HYDE, R. E.,
H. HOWE.,
GEO. ROSS,
} *Members.*

Appendix A.

See letters Nos. 2525 and 4460, page 573.

Appendix B.

From CAPTAIN H. HOWE, Deputy Master Attendant, in charge, to the Secretary to the Government of Bengal,—(No. 2527A, dated the 20th October 1864.)

WITH reference to my letter No. 2525 of this date, recommending the appointment of a Committee to enquire generally into the question of the moorings in this Port, pending the consideration of the introduction of screw moorings, I have the honor to state that I have since had an opportunity of reading a work on "Sub-Marine Foundations, particularly the Screw Pile and Moorings, by Alexander Mitchell, M. I., C. E., and an account of the Maplin Sand Light-house, by John B. Redman, M. I., C. E., together with Excerpt Minutes of Proceedings of the Institution of Civil Engineers, by permission of the Council."

Published by Mitchell's Screw Pile and Mooring Company, 17, Great George Street, Westminster.

A perusal of this work, and an inspection of the plans and sketches of the moorings now in use in several of the harbours in England, especially in Newcastle-upon-Tyne, and Sunderland, and in the Port of London within the jurisdiction of the Corporation of the Trinity House, remove all possibility of doubt on the subject, and must satisfy all who investigate it as to the immense security and safety as regards holding power of the screw pile over the moorings commonly used, which are the Span Chain Mooring, and the Sinker or Mooring Block.

The Span Chain is in use in this Port. The Sinker is a heavy block of stone or iron laid upon the surface in the bed of the river, or placed in an excavation prepared for its reception not used here; but both of these continue to be the only moorings in use at the Royal Dock-yards, probably on account of the value of the old stock or material, and to their not being much exposed.

At the same time it must be remarked, in justice to the moorings in this Port, that they have been laid under a better and more systematic method than those in use in the Port of London prior to the introduction of the screw pile moorings; a glance at the sketches Nos. 1 and 2, which accompany this letter, will, I think, clearly prove this.

As proofs of the estimation in which the screw pile moorings are held in England, the Corporation of Newcastle-upon-Tyne, within a few months of the expiration of the inventor's privilege, and when the renewal of it appeared doubtful, paid, for the permission to use the patent in the Tyne as applied to moorings alone, the sum of £2,500, and they have carried out the system to a considerable extent with great benefit; and it is recorded in the pamphlet which is before me, published by authority, that, on the occasion of a very heavy storm which occurred when nearly a thousand ships were wind-bound in the river, and the greatest consternation prevailed, not a single mooring gave way, although they were all fearfully tried, and not £10 worth of damage was done, whilst in the neighbouring port of Sunderland injury was sustained by the shipping to the extent of nearly £30,000. Another proof of the value set upon the screw moorings is that in 1847 the Judicial Committee of the Privy Council, before whom an application was then argued for a renewal of the patent then about to expire, granted a warrant for a new patent for the period of fourteen years.

The screw pile, as described in the pamphlet, is simply a bar of iron with a wrought iron screw point, having at its lower extremity a broad plate or disc of metal in a spiral or helical form, on the principle of the screw, in order that it should enter the ground with facility, thrusting aside obstacles to its descent without materially disturbing the texture of the strata it passed through, and that it should at the same time offer an extended base either for resisting downward pressure, or an upward strain.

When this broad spiral flange or "Ground Screw" is employed as a mooring to resist an upward strain, its holding power depends upon the area of its disc, the nature of the ground into which it is inserted, and the depth to which it is forced beneath the surface.

The proper area of the screw must, in every case, be determined by the nature of the ground and the purpose for which required; the largest size yet used has been four feet in diameter, and the depths to which they have been inserted at Newcastle vary from 10 to 20 feet.

It is evident, then, that such a flange or ground screw inserted to a depth of 20 feet has immense holding power in the ground. In the words of the pamhplet, the mass of ground thus affected* in the case of the screw mooring is in the form of the frustum of a cone inverted, that is, with its base at the surface, the breadth of the base being in proportion to the tenacity of

* That is to say, disturbed before the mooring can be displaced by any direct force.

the ground; this is pressed on by a cylinder of water equal to its diameter, the axis of which is its depth, and the water again bears the weight of a column of air of the diameter of the cylinder; if therefore a cast iron screw of a given area be forced into the earth to a certain depth, it must afford a firm point of attachment for a buoy chain in every direction, and will oppose a powerful resistance even to a vertical strain, which generally proves fatal to sinker moorings, depending, as they do, chiefly on their specific gravity.

The following description of the method of mooring vessels in the port of Newcastle-upon-Tyne is extracted from the Proceedings of the Institution quoted:—

"A heavy ground chain composed of links each 3 feet in length, of round iron 3¼ inches in diameter, was stretched along the bed of the river in the deep water, and in the direction of the current, instead of, according to the old system, placing it as a bridle across the stream. To this chain, at given distances, marking the centre of each tier and the mid distance between, were shackled studded link mooring chains of 2¼-inch iron, which had been previously laid down with the lower extremity of each attached to a screw mooring inserted into the bottom of the river at each spot, to depths varying from 10 feet to 20 feet; the depth of water at low water spring tides varied from 15 feet to 24 feet, where rock was met with, it was penetrated by the wrought iron screw point for about 1 foot, or as far as the underside of the table of the screw."

Our ground chain is 2¾ inches.

To bring into practical usefulness the lesson now learned, nothing further seems necessary, should Government approve, than that Government should, as immediately as it deems proper, cause communication to be entered into with Mr. Mitchell relative to the adoption of his moorings in this Port, furnishing him with full particulars of our wants and requirements, the nature and extent of the ground to be brought under the operation of his patented method, the number of screw piles, &c., required, and every other kind of information that can possibly be afforded to insure a practical and successful result.

In the meantime the moorings can be re-laid with the large reserve means at our disposal, and, on the introduction of the screw moorings, the old stock may be sold off; the cheapness of the new method will, in a few years, abundantly re-pay the cost of introducing it, and save the annual expense of keeping up the present chain moorings.

The system is equally applicable to Light-houses and to Beacons in substitution of buoys in many parts of the river not liable to change, and I shall make these the subject of a separate communication.

Appendix C.

From Captain S. G. Boon, Secretary, to Captain J. Reddie, Master Attendant.

By direction of the Committee on the Moorings of the Port of Calcutta, I have the honor to request you will be good enough to furnish me with the under-mentioned information:—

1*st*.—Plan of tiers of moorings drawn to scale.

2*nd*.—Description of moorings shewing classes and number of each class and measurement of each.

3*rd*.—A statement shewing sizes of ships put into the several classes of moorings, and what regulates this operation.

4*th*.—Statement shewing the date of laying down each mooring, date of last examination and the extent of examination, and the official whose duty it was to make it, and a statement of repairs, if any, which had been made during the last three years, and the failures which have occurred during that time.

5*th*.—Copy of the rules of supervision and examination of each mooring, and of the rules under which ships are moored, the strength of the establishment for overhauling the fixed moorings, and number of boats and men.

6*th*.—Time it takes to examine each mooring, and the number of moorings examined in the year.

Appendix Ca.

From J. F. Peterson, Esq., Harbour Master, to Captain J. G Reddie, Master Attendant,—(No. 1317, dated the 8th November 1864.)

With reference to Captain S. G. Boon's letter of the 4th instant to your address, herewith returned, I beg to furnish the information required, as much as I can:—

1. The plan of the tiers of moorings to be drawn to scale I am unable to supply, as I have no Draftsman allowed for my Office.

2. The classes and number of each class, and measurement of each class of moorings are given in Statement A.

3. Ships are placed into the different classes of moorings according to their length, size, and draft.

4. The moorings are examined during the fine weather season; the last time that they were examined was from November 1863 to May 1864 by over-hauling, weighing, and re-laying them; and when any of them are brought home during the the freshes they are immediately re-layed. The Deputy Harbour Master superintends the whole of the operations under my directions. Statements B., C., and D. shew the repairs that have have been executed during the past three years.

5. There is no written rule by which the moorings are examined, but they are all overhauled every year as mentioned before, * and ships are hauled into the moorings on the flood tide during the fine weather season, and on the ebb-tide during the freshes. Two anchor boats, with 21 men attached to each boat, is the Establishment employed in examining the moorings.

6. The time it takes to examine and re-lay each mooring is uncertain, as it depends upon the extent of the repairs required to be done, and the whole of the moorings are examined every year.

No. 2645.

Memo.—Forwarded to Captain S. G. Boon, Secretary to the Committee on Moorings, with reference to his letter of the 4th instant.

JOHN G. REDDIE,
Master Attendant.

Master Attendant's Office,
The 8th November 1864.

* Mr. Peterson subsequently explained that written orders for the examination of the moorings are issued annually.

Expenditure of Anchors, Chains, Shackles, Swivels, and Rings in the Harbour Master's Department from 1*st May* 1861 *to* 30*th April* 1862.

STATEMENT B.

		Connecting Shackles.	Number 1 Shackles.	Number 2 Shackles.	Number 3 Shackles.	Number 4 Shackles.	Buoy Swivels.	Mooring Swivels.	Bridle Swivels.	Rings.	2¾ Inch Chain.	2½ Inch Chain.	2¼ Inch Chain.	2 Inch Chain.	1¾ Inch Chain.	1¼ Inch Chain.	1⅛ Inch Chain.	1⅛ Inch Chain.	1⅛ Inch Chain.	2 Inch or Chain for Buoy.	1¾ Inch or Chain for Buoy.	1⅜ Inch or Chain for Buoy.	Number of Anchors.	Guns.	Cwt.	Quarters.	lb.	Fore-locks.
1861.																												
May 2nd	For re-laying the in-shore Ebb Anchor of No. 2 Bankshall Moorings of Diamond Harbour Moorings Materials	...	...	...	...	...	...	...	...	...	...	19	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 10th	„ Ditto the 3rd set of Double Moorings of Salt Golahs of Ditto	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 28th	„ laying the in-shore Flood Anchor of No. 4 Calcutta Moorings Ditto	1	...	1	5	1	...	...	...	2	8	...	...	12	...	...	...	...	...	1½	...	...	1	...	55	...	...	6
„ 29th	„ Ditto the Flood Anchor of No. 1 Mint Swinging Moorings ...	2	...	...	1	...	...	...	...	...	...	8	...	15	...	...	...	...	...	...	...	...	1	...	wooden 40 to 45	...	...	3
June 6th	„ re-laying the 2nd Ebb Anchor from the shore of No. 5, Cooly Bazaar Moorings	1	...	...	...	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	.....	...	...	6
„ 10th	„ overhauling Nos. 8 and 2, Calcutta, and No. 2, Esplande Moorings ...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	1½	...	...	...	...	.....	...	...	17
„ 10th	„ re-laying the Flood Anchor from the shore of No. 1, Cooly Bazaar Moorings	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7	...	...	...	...	...	...	.....	...	...	5
July 15th	„ re-laying the Flood Anchor of No. 11, Esplanade Moorings	...	...	...	...	...	...	...	...	...	...	...	...	15	...	...	...	...	...	...	...	...	1	...	wooden stock 25	...	...	...
„ 22nd	„ re-laying the Flood Anchor of Government Sail Loft Moorings	2	...	...	...	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 27th	„ burying an Anchor of E. I. Railway Moorings off Howrah (Old Police Hulk's Anchor)	1	...	...	...	...	...	...	...	1	...	...	...	15	...	...	...	...	...	...	...	...	1	...	25 to 28 iron	...	...	...
Aug. 5th	„ laying a set of Swinging Moorings above No. 11, Calcutta Moorings...	...	...	...	...	4	...	...	...	1	...	...	...	...	...	...	...	45	...	...	...	...	2	...	22 to 25 each	...	...	...
„ 18th	„ re-laying the Ebb Anchor of I. G. S. N. Company's Moorings off Garden Reach	1	...	...	...	...	...	...	...	...	...	...	...	17	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
Nov. 7th	„ re-laying the Upper Buoy Ditto Ditto	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	.....	...	...	...
„ 25th	„ burying a sal post for the Ebb Anchor fastening of No. 1, Esplanade Moorings	...	...	...	1	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 30th	„ re-laying an old post for the flood in-shore fastening of Engine House Moorings	...	...	...	1	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
Dec. 20th	„ re-laying the 2nd Flood Anchor of new No. 3, Calcutta Moorings	...	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 27th	„ re-laying the 3rd Ditto Ditto	...	...	2	...	...	...	...	...	...	4	...	...	8	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
1862.																												
Feb. 15th	„ burying a sal post for Messageries Imperiales Moorings at Garden Reach	...	...	...	1	...	...	...	...	...	...	...	...	15	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 18th	„ Ditto Ditto Ditto	...	...	...	1	...	...	...	...	...	...	...	...	15	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 27th	„ Ditto Ditto Ditto	...	...	...	...	...	...	...	...	...	...	...	...	9	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 27th	„ re-laying the Flood Anchor of No. 3, Garden Reach Moorings	2	...	...	...	...	...	...	...	...	...	...	...	20	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
Mar. 6th	„ burying a sal post for the in-shore fastening of Government Coal Depôt	1	...	...	...	...	...	...	...	...	...	...	...	4½	...	...	...	...	...	...	...	...	...	...	.....	...	...	...
„ 28th	„ re-laying No. 4, Garden Reach Moorings (old materials of Nos. 9 and 10 Esplanade were used)	1	...	3	5	1	1	1	...	2	...	32	...	30	...	...	...	...	...	2	...	...	2	...	65 / 40 to 45	...	...	...
„ 31st	„ laying the Ebb Anchor of No. 1, Cooly Bazaar Moorings	...	1	1	5	1	1	1	...	2	8	...	...	15	...	...	20	...	...	2	...	...	2	...	65 / 17	...	...	...
Apr. 4th	„ burying a sal post for Messageries Imperiales Moorings at Garden Reach	...	...	...	2	...	...	...	...	1	...	...	...	8	...	...	...	...	...	...	...	...	...	...	..... iron	...	...	...
„ 23rd	„ laying a large anchor in-shore of No. 9, Esplanade (old materials of the same moorings outside berth)	1	1	1	1	...	...	...	...	...	8	...	...	30	...	...	...	...	...	...	...	...	1	...	68 to 70	...	...	...
„ 24th	„ laying the in-shore Ebb Anchor of Ditto Ditto	...	1	...	2	...	...	...	...	...	8	...	...	15	...	...	...	...	...	...	...	...	1	...	68	...	...	...
„ 24th	In overhauling the Garden Reach, Kidderpore, and Cooly Bazaar Moorings	...	...	...	3	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	7 dz.
„ 28th	„ re-laying No. 5, Cooly Bazaar Fixed Moorings, which were sunk by the *Edith Moore*, under charge of Mr. L. Behrend	...	...	...	...	3	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...

HARBOUR MASTER'S OFFICE;
The 2nd May 1862.

J. F. PETERSON.
Harbour Master.

Expenditure of Anchors, Chains, Shackles, Swivels, and Rings in the Harbour Master's Department from 1st May 1862 to 30th April 1863.

STATEMENT C.

		Connecting Shackles.	No. 1 Shackles.	No. 2 Shackles.	No. 3 Shackles.	No. 4 Shackles.	Buoy Swivels.	Mooring Swivels.	Bridle Swivels.	Rings.	2¾ Inch Chain.	2½ Inch Chain.	2 Inch Chain.	2⅛ Inch Chain.	1⅞ Inch Chain.	1¾ Inch Chain.	1⅝ Inch Chain.	1½ Inch Chain.	1⅜ Inch Chain.	1¼ Inch Chain.	1⅛ Inch Chain.	2 Inch Chain for Buoys.	1¾ Inch Chain for Buoys.	1⅝ Inch Chain for Buoys.	No. of Anchors.	Cwt.	Quarter.	Guns.
1862.																											
May 13th	Re-laying the seond flood Buoy from the shore of No. 8 Calcutta fixed Moorings			1	4								15	8							1½			1	45 to 50		
„ 23rd	Ditto the flood anchor of Government Sail Loft fixed Moorings										8																
June 3rd	Ditto the third anchor of No. 2, Cooly Bazaar fixed Moorings												12														
„ 7th	Laying a set of Swinging Moorings off Kidderpore for the River Surveying Brig							1											30					2	42 to 45		
„ 20th	Ditto ditto ditto ditto to the Westward for the Steamer *Celerity*	2		2	5	1		1					30					15	15					2	40 to 45 and 28 to 32		
„ 25th	Re-laying the fourth flood anchor of new No. 3, Calcutta Moorings	1											9											2			
„ 28th	Ditto the fifth ditto of ditto												8														
July 3rd	Ditto the second ditto of No. 4, Calcutta Moorings	1									8		10														
„ 7th	Ditto the fourth ebb anchor of No. 2, Prinsep's Ghaut Moorings	1			2							10															
„ 10th	Ditto the second flood ditto of ditto			1	3								8														
„ 14th	Ditto the third ebb ditto of ditto				1														15								
„ 17th	Laying the backing ditto of No. 10, Calcutta Moorings				4										30									2	42 to 45 wooden		
„ 18th	Ditto ditto ditto				1													16						1	17 to 20 iron		
„ 18th	Ditto an in-shore Mooring above ditto for the East India Steam Navigation Co.'s Steamers				7	1	1	1		1						36					1½			2	8, wooden 18		
„ 21st	Ditto in-shore flood anchor of No. 2, Calcutta Moorings			2	6	1	1	1			8		15					30			1½			2	70 iron each		
Aug. 27th	Ditto a set of Ebb Moorings above Juggurnath Ghaut for East India Railway Company				5	3	1	2								28					1½			2	34		
„ 27th	Ditto backing anchor for ditto																	26						2	8 each		
„ 27th	Ditto a set of flood ditto for ditto	1			6	4	1	1								14	2							1	34		
Oct. 27th	Re-laying the 2nd ebb anchor of No. 5, Cooly Bazaar Moorings				1					2																	
Nov. 3rd	Overhauling & re-laying the P. & O. Co.'s Moorings, Govt. Coal Depots, & Sail Loft Moorings				4	2																					
Dec. 6th	Ditto ditto the Cooly Bazar and Prinsep's Ghaut Moorings				2	2																					
1863.																											
Jan. 14th	Re-laying the middle ebb anchor of Indian General Steam Navigation Company's Moorings												6														
„ 28th	Ditto the flood anchor of the Ebb Buoy of No. 3, P. and O. Co.'s fixed Moorings	2		1	2								33											1	71	2	
„ 28th	Ditto the ebb chain of the flood Buoy of P. and O. Co.'s fixed Moorings	1		1	4								15														
„ 30th	Overhauling the Salt Golah fixed Moorings					1																					
Feb. 11th	Ditto No. 10, and above No. 10, Calcutta Moorings				2	4																					
„ 17th	Re-laying the fourth ebb anchor from the shore of No. 3, Calcutta Moorings	2		1	1								4					5									
„ 19th	Ditto the fifth ebb anchor from the shore of No. 3, Calcutta Moorings	1																5									
„ 23rd	Ditto the third ditto ditto	2			2		2											12½									
„ 23rd	Lengthening No. 3, P. and O. Co.'s fixed Moorings				1																						
„ 27th	Re-laying the outside fixed flood Moorings of No. 3, Calcutta				1		1																				
Mar. 5th	Ditto No. 1, Bankshall fixed Moorings					2																					
„ 7th	Ditto the 4th ebb anchor of No. 2 Bankshall				2	1							4					5									
„ 9th	Re-placing a Buoy in the P. and O. Co.'s Moorings					1																					
„ 10th	Re-laying the 5th ebb anchor of No. 2, Bankshall Moorings	1					1											4½									
„ 14th	Ditto the in-shore flood ditto of No. 8, Esplanade Moorings				3								12														
„ 16th	Ditto the third ebb ditto of No. 1, Bankshall ditto	1	1	1	1								8								1½						
„ 16th	Ditto the out-side ebb and ditto ditto	1									8																
„ 20th	Ditto ditto flood ditto of No. 1, Prinsep's Ghaut Moorings			1			1																				
„ 24th	Ditto ditto ditto of ditto					1																					
„ 24th	Ditto ebb ditto of No. 2, Prinsep's Ghaut Moorings	1		1		1																					
Apl. 5th	Re-placing the Nos. 9 and 10 Esplanade Moorings				5	4	2			3			4		22						1½			1	53		
„ 16th	Ditto a Pendant of No. 4, Calcutta Moorings				1																						
„ 20th	Re-laying the Swinging Moorings off Howrah Dock				2	1	1												10								
„ 20th	Ditto the out-side ebb anchor of No. 7, Calcutta Moorings	1			1																						
„ 21st	Laying a backing anchor for Inland Steamer's Moorings off the Mint						3							4										1	2		
„ 27th	Re-laying the flood Moorings of No. 3, Cooly Bazaar			1	1													12									

HARBOUR MASTER'S OFFICE,
The 5th May 1863.

J. F. PETERSON,
Harbour Master

Expenditure of Anchors, Chains, Shackles, Swivels, and Rings in the Harbour Master's Department from 1st May 1863 to 30th April 1864.

STATEMENT D.

		Connecting Shackles.	Number 1 Shackles.	Number 2 Shackles.	Number 3 Shackles.	Number 4 Shackles.	Buoy Swivels.	Mooring Swivels.	Bridle Swivels.	Rings.	2¾ Inch Chain.	2½ Inch Chain.	2¼ Inch Chain.	2 Inch Chain.	2⅛ Inch Chain.	1⅞ Inch Chain.	1½ Inch Chain.	1¼ Inch Chain.	1⅛ Inch Chain.	1 Inch Chain.	2 Inch Chain for Buoys.	1⅛ Inch Chain for Buoys.	Number of Anchors.	Cwt.	Quarter.	lb.	Guns.	Forelocks.
1863.																												
May 5th	Re-laying the fourth flood Anchor of No. 1 Prinsep's Ghaut Fixed Moorings	2	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	...
„ 7th	Ditto the third ditto of ditto	2	...	...	2	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...	1½	...	...	.....	...	...	...	3
„ 7th	Re-placing Nos. 1 and 2 Garden Reach Fixed Moorings	...	...	...	2	2	2	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	...
„ 11th	Re-laying the 2nd flood anchor of No. 1 Prinsep's Ghaut Fixed Moorings	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	14	...	...	...	...	.....	...	...	...	...
„ 14th	Re-laying the 4th Ebb anchor of New No. 4, Cooly Bazaar Fixed Moorings	1	...	...	1	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	.....	...	...	...	2
„ 15th	For overhauling the Hooghly and Union Dock Swinging Moorings	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	...
„ 18th	„ Re-laying the third flood anchor of No. 2, Prinsep's Ghaut Fixed Moorings	2	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1½	...	...	...	...	.....	...	...	...	...
„ 20th	„ Ditto fourth ditto of New No 3, Calcutta Fixed Moorings	...	...	...	3	...	1	...	...	...	7	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	4
„ 21st	„ Ditto the Ebb anchor of No. 8, Esplanade Fixed Moorings	2	...	...	...	1	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	...	...	.....	...	...	...	6
„ 23rd	„ Ditto 5th ditto of New No. 3, Calcutta ditto	...	...	...	2	1	1	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	2
June 1st	„ Ditto 5th ditto of New No. 4, ditto ditto	1	...	...	...	1	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	2
„ 3rd	„ laying the flood anchor of the Docking Buoys off Kidderpore	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	25	...	...	...	1	24	2	3	...	...
„ 9th	„ re-laying the fifth flood anchor of No. 5, Calcutta Fixed Moorings	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	2
„ 4th to 14th	„ overhauling the Kidderpore Fixed and Swinging Moorings	...	...	...	2	4	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	12
„ 14th to 21st	„ Ditto Nos. 6, 7, and 8, Calcutta Fixed Moorings	...	...	...	...	4	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	13
„ 22nd	„ re-laying the 3rd Ebb Anchor of No. 6, Calcutta Fixed Moorings	1	...	...	1	...	...	...	...	...	...	...	...	12	...	...	...	...	...	1	...	...	...	.....	...	...	...	2
July 1st to 26th	„ overhauling the Cooly Bazaar and Prinsep's Ghaut ditto	...	...	...	3	20	15	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	.....	...	...	...	54
August 26th	„ laying a flood anchor outside of No. 11, Calcutta ditto	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	...
Dec. 2nd	„ Ditto an extra set of Ebb Moorings outside of ditto	...	...	...	1	1	1	...	...	...	...	...	...	80	...	...	...	...	...	...	...	...	...	.....	...	...	...	...
„ 5th	„ re-laying the Ebb Moorings above the New Mint	1	...	...	...	1	1	...	...	...	...	...	...	...	...	...	12½	...	...	...	...	...	1	.....	...	...	...	...
1864.																												
Feb. 6th to 14th	„ overhauling the Docking and Swinging Moorings off Sulkeah, Garden Reach, and Kidderpore Moorings	...	...	...	7	16	14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	33
„ 15th	„ re-laying the fourth flood anchor of New No. 3, Calcutta Fixed Moorings	...	...	...	3	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	2	...	...	.....	...	...	...	...
„ 16th	„ re-laying the fourth Ebb Anchor of No. 2, Banksball Fixed moorings	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	.....	...	...	...	2
„ 18th	„ laying an In-shore ditto ditto of No. 2, Prinsep's Ghaut ditto	1	...	1	3	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	.....	...	...	...	4
„ 23rd	„ re-laying the third ditto ditto of the Pilot Brigs ditto	2	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	4	...	...	...	...	.....	...	...	...	...
„ 29th	„ laying the fourth flood ditto ditto ditto ditto	...	1	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	3½	...	...	...	1	26	2	14	...	...
April 1st to 17th	„ overhauling the Calcutta, Esplanade, Cooly Bazaar, Prinsep's Ghaut, and Pilot Brigs ditto	...	...	...	15	22	23	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	.....	...	...	...	192
„ 18th	„ laying a backing anchor to an Additional flood Mooring of No. 11, Calcutta	2	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	16	...	...	...	1	12 to 14	...	...	...	...

HARBOUR MASTER'S OFFICE;
The 11th May 1864.

J. F. PETERSON,
Harbour Master.

Appendix D.

From S. C. Bayley, Esq., Junior Secretary to the Government of Bengal, to the President and Members of the Committee appointed to enquire into the adaptability of Screw Moorings to the circumstances of the Port of Calcutta,—(No. 4594, dated the 29th October 1864.)

In continuation of my endorsement No. 4491, dated the 25th instant, I am directed to forward the accompanying letter,* with enclosure, from Captain A. R. Weston, and to request that your Committee will take into their consideration and will report on the questions mooted by that gentleman, as well as on the subject of Moorings, into which you were more particularly requested to enquire.

* Dated the 28th September last.

From Captain A. R. Weston, P. & O. S. S. *Simla*, to His Honor the Lieutenant-Governor of Bengal,—(dated the 28th September 1864.)

The magnitude of the trade of Calcutta, and the great increase which must be looked for in it as the resources of British India become developed, render it most imperative that the aids to navigation in approaching and leaving the Port should be of the most perfect kind attainable, and be maintained in the highest possible state of efficiency.

2. Believing that this matter has already engaged the attention of Government, and thinking that you may desire to be informed of the opinion of some who, from the nature of their profession, are practically acquainted with the subject, I venture to lay before you the following remarks, which will, I trust, be found worthy of your consideration.

3. The present system of lighting and buoying the entrances and channels of the Hooghly, though perhaps the best that was available at the time when it was adopted, is quite inadequate to the requirements of the present day, and has in principle been superseded by modern discoveries, presenting the advantages of greater efficiency combined with considerable reduction in expense.

4. The invention of Screw Piles has enabled Light-houses to be securely placed in situations where it had previously been considered impossible to maintain any other Beacon than a Floating Light Vessel, and as the success of the new principle has been so fully demonstrated by the Light-houses already in full work at the several places named in the margin, there appears to be no reason why the present Light Vessels (the Eastern Channel and Lower Gasper) at the entrance of the Hooghly should not be re-placed by Light-houses on Screw Piles.

Screw Pile Light-houses.
Maplin Sand.
Fleetwood.
Belfast.
Dundalk.
Chapman Sand.
Spit Bank.
Sandkey-Florida.
Brandywine Delaware.
Gun Fleet Sand and others.

5. A very important advantage possessed by structures raised on these piles is the small surface offered by them to the run of the tide, or the stroke of a wave, whilst they afford facilities for forming so rigid a structure, that, as in the case of the Fleetwood and other Light-houses, scarcely any vibration can be perceived even in the heaviest weather.

6. Looking out at night, and especially during and after bad weather, for intricate positions, it is of the utmost importance that mariners should rely with undoubting confidence, not only on the stability of the light, but also on its unvarying position and appearance. All these advantages are possessed by fixed lights, (that is, Lights shewn from Light-houses,) but in tempestuous weather the Floating Light Ships are nearly obscured by the spray, and their lights have no steadiness on account of the constant motion, whilst in consequence of their breaking adrift from their moorings, hundreds of lives and millions of property have been lost. Nor can they be said to occupy any precise position, shifting, as they do, with the wind and tide, twice the length of the chains by which they ride.

7. By the use of iron, the ravages of the Teredo Navalis and other seaworms, so much dreaded for timber structures on almost every coast, may be entirely disregarded, and experience has shewn that no apprehension need be entertained of the prejudical action of salt water upon Screw Piles; neither the wrought nor the cast iron of the Maplin Sand Light-house, which was fixed nearly thirty years ago, being in the slightest degree injured; the Courtown Pier, built sixteen years ago, being in an equally good state of preservation.

8. The channels of the Hooghly are at present marked by Buoys, which, from the nature of their construction, are continually getting out of order and drifting from their proper positions, becoming thereby sources of doubt and perplexity and even of danger, in addition to the enormous cost of maintenance.

9. I propose—

(*a.*) To build a Light-house of the first order, Catoptric, revolving at 120 feet above high water level, in lieu of the present Eastern Floating Light Vessel.

(*b.*) To build a Light-house of the second order, Catoptric, fixed at 60 feet above high water level, in lieu of the present Lower Gasper Light Ship.

(*c.*) To place Screw Pile Beacons in lieu of Buoys to mark the channels in the Hooghly.

10. Having, with the assistance of one of the Senior Pilots, selected six Buoys and a similar number of Beacons (named in the margin) occupying the most important positions as crossing and leading marks, I suggest that these should first be re-placed by Screw Pile Beacons, as an experiment previous to adopting the system throughout.

Buoys.	
Fultah Sand in	7 fms.
Mukraputty in	5 „
Saugor Anchoring	7 „
Light Saugor	7 „
„ Ridge in	7 „
Culpee in	8 „

Shore Beacons.
Mooneekolly Point.
Moyapore „
Sister Trees „
Deep Water mark.
Middle Point.
Mud „

11. I enclose a Statement shewing the comparative cost of the proposed system as compared with the present, both as regards outlay and annual expenditure.

12. The figures in this Statement require little comment. A very important feature is the enormous saving in the annual expenditure, amounting to £12,944 per annum, by which, in the course of three years, thirty-six weeks, the whole amount of the original outlay would be recovered, while the Light-houses and Beacons (with perhaps the exception of the wooden tops and hoods of the latter) would probably be in better condition than ever; whereas in the present system (as will be seen by the Statement) the original outlay is doubled in four years, twenty-six weeks, by the excess in the annual expenditure, the property being then more than half worn-out. A more important feature still is the greater efficiency of Light-houses and stationary Beacons as compared with Light Vessels and Buoys, which, I submit, should be sought for at any cost.

13. Should you wish to receive fuller details respecting my proposed system, I shall be most happy to wait upon you with drawings and specifications, and trusting that the matter will receive the favorable consideration of Government.

An approximate Block Account and Annual Expense of Lighting and Buoying the River Hooghly,

Present System.	£.	£.	Proposed System.	£.	£.
To cost of the Eastern Floating Light Ship, complete ...	7,032		To cost of a Light-house, first order, Catoptric, revolving 120 feet above high water level in 9 fathoms, in lieu of the Eastern Floating Light Ship ...	22,000	
„ „ Light Gasper Light Ship „ ...	8,382		To cost of a Light-house, second order, Catoptric, fixed 60 feet above high water level in 4 fathoms, for Lower Gasper Light Ship	15,000	
„ cost of Buoys, say 200 first class, at £160 ...	32,000		To Screw Pile Beacons (say 200 first class) ...	9,540	
„ „ of a Buoy Brig, complete	10,760		To fitting two sets of Screwing Apparatus into the Surveying Vessel	200	
			To wooden ends and hoods for 200 Beacons ...	1,000	
					47,740
					10,434
		58,174			58,174
To one year's maintenance of Eastern Floating Light Ship	3,729		To one year's maintenance of Light-house, first order...	500	
To one year's maintenance of Light Gasper Light Ship	3,354		To ditto ditto ditto second „ ...	450	
Ditto ditto of Buoy Brig ...	3,839		To ditto ditto 200 Beacons (coat of paint)	250	
Ditto ditto of Buoys	3,222				1,200
		14,144			12,944
					14,144
Excess in Annual Expenditure in 4 years, 26 weeks, of present system	58,174		Saving in Annual Expenditure of proposed system in 3 years, 36 weeks	47,740	
Original outlay of present system	58,174		Original outlay of proposed system	47,740	
Ditto doubled in 4 years, 26 weeks ...	116,348		Ditto recovered in 3 years, 36 weeks	00,000	

N. B.—The cost and annual expense of the Surveying Vessel has been purposely omitted, as it would appear equally in both systems.

E. E.,

The 28th September 1864.

A. R. WESTON, *Captain.*

Appendix E.

From the Acting Secretary to the Municipal Commissioners of the Town of Canning, to the Secretary to the Government of Bengal,—(dated the 28th October 1864.)

In compliance with a Resolution passed at a Meeting of the Municipal Commissioners for the Town of Canning held here on the 25th instant, I have the honor to submit, for consideration of His Honor the Lieutenant-Governor, copy of a letter addressed to me on the subject of lighting and buoying the River Mutlah, together with a Statement setting forth the difference between present cost of lighting and buoying the river, and estimated cost of proposed method as set forth by Captain Weston.

No. 4702.

Forwarded for the consideration of the President and Members of the Committee appointed to enquire into the adaptability of Screw Moorings to the circumstances of the Port of Calcutta. The return of the enclosures is requested.

By Order of the Lieutenant-Governor of Bengal,

S. C. Bayley,

Junior Secy., Govt. of Bengal.

Fort William,
The 1st November 1864.

From Captain Arnold R. Weston, to F. Schiller, Esq., Borradaile, Schiller & Co.,—(dated the 28th September 1864.)

Now that the development of the Mutlah is fast becoming an accomplished fact, the efficient lighting the entrance and buoying the channels of the river is a question of the highest importance, and, before the present system of Light Ships and Floating Iron Buoys is too largely or permanently taken up, I would like to propose another system, which I feel sure will be found well worthy the consideration of the Chamber of Commerce, or whatever authority has the conservancy of the Port.

The invention of Screw Piles has enabled Light-houses to be placed securely in situations where it had previously been considered impossible to maintain any other Beacon than a Floating Light Ship. The success of the principle has been fully demonstrated by the Light-houses already in full work at the several places named in the margin.

Screw Pile Light-houses.
Maplin Sand.
Fleetwood.
Belfast.
Dundalk.
Chapman Sand.
Spit Bank.
Sandkey-Florida.
Brandywine Delaware.
Gun Fleet Saud and others.

A very important advantage possessed by structures raised on these piles is the small surface offered by them to the run of the tide, or the stroke of a wave, whilst they afford facilities for forming so rigid a structure that, as in the case of the Fleetwood and other Light-houses, scarcely any vibration can be perceived even in the heaviest weather.

Looking out at night, and especially after bad weather, for intricate positions, it is of the utmost importance that mariners should rely with undoubting confidence, not only on the stability of the Light, but also on its unvarying position and appearance. All these advantages are possessed by fixed Lights (that is, Lights shewn from Light-houses,) but in tempestuous weather the Floating Light Ships are nearly obscured by the spray, whilst in consequence of their breaking adrift from their moorings, hundreds of lives and millions of property have been lost. Nor can they be said to occupy any precise position, shifting, as they do, with the wind and tide, twice the length of the chains by which they ride.

By the use of iron, the ravages of the Teredo Navalis and other sea-worms, so much dreaded for timber structures on almost every sea coast, may be entirely disregarded, and experience has shewn that no apprehension need be entertained of the prejudicial action of salt water upon the Screw Piles; neither the wrought nor the cast iron of the Maplin Sand Light-house, which was fixed nearly thirty years ago, being in the slightest degree injured; the Courtown Pier, built sixteen years ago, being in an equally good state of preservation.

The channels of the Mutlah are at present marked by Buoys, which, from the nature of their construction, are continually getting out of order and drifting from their proper positions, becoming thereby sources of doubt and perplexity, and even of danger in addition to the enormous cost of maintenance.

I propose—

(*a*) To build a Light-house of the first order, Catoptric, fixed 90 feet above high water level on the tail of the Bulcherry Sand in 6 fathoms in lieu of the present Light Vessel.

(*b*) To build a Light-house of the second order, Catoptric, fixed 50 feet above high water level on the western edge of the Roy Mutlah Sand in 5 fathoms.

(*c*) To substitute Screw Pile Beacons in lieu of Buoys to mark the channels.

I enclose an approximate comparative Statement shewing outlay and annual expenditure of both systems, from which you will see the saving of the annual expenditure of the proposed system is enormous. The greater efficiency (the chief point to be considered) of the proposed system must be patent to all; for instance, a Light-house can never get adrift—

Being more solid, it can carry heavier lanterns, and consequently shew a brighter light.

Being higher, the light is seen at a greater distance, and thus sooner picked up.

Beacons can never get adrift, and thus can always be depended upon.

Being solid they can carry higher and larger hoods, and are consequently distinguishable more easily at great distances, being also readily shifted, the annual expense of doing which will be hardly appreciable, as the surveying vessel, being fitted with the Screwing Apparatus, would herself shift them, and in a quarter of the time now sometimes occupied by the present Buoy Brig in the Hooghly, and thus remove two of the heaviest items in the Statement.

The constant complaints brought against the present system as used in the Hooghly, upon every one of the above points, should be quite sufficient to condemn it. At all events the Conservators of the Port should pause ere they commit themselves irrevocably to the present system.

Knowing the deep interest you take in all that concerns the Mutlah, I unhesitatingly leave my proposition in your hands, and should you wish further details, I shall be happy to supply you with drawings and estimates.

An approximate Block Account and Annual expense of Lighting and Buoying the River Mutlah.

PRESENT SYSTEM_____AS COMPARED WITH_____PROPOSED SYSTEM.

	£.	£.		£.	£.
To cost of a new Light Ship, for Bulcherry Sand, complete with Lanterns, &c. ...	8,382		To cost of a Light-house, first order, Catoptric, fixed 90 feet above high water level in 6 fathoms, about ...	15,000	
To cost of a new Light Ship, for Roy Mutlah Sand, complete with Lanterns, &c. ...	7,032		To cost of a Light-house, second order, Catoptric, fixed 50 feet above high water level in 5 fathoms, about	12,000	
To 35 first class Buoys complete (at the Hooghly rate) ...	5,600		To 35 first class Screw Pile Beacons ...	1,670	
To a new Buoy Brig, complete ...	10,760		To H and Pr. and Hoods for ditto, about	200	
			To fitting two sets of Screwing Apparatus into the Surveying Vessel about	200	
					29,070
					2,704
		31,774	To one year's cost of maintenance of first order Light-house ...	500	31,774
To one year's cost of maintenance of Light Ship, on the Bulcherry Sand ...	3,729		To one years's cost of maintenance of second order Light-house ...	450	
To one year's cost of maintenance of Light Ship on Roy Mutlah Sand ...	3,729		To one year's cost of maintenance of 35 Beacons, (Paint, &c.) ...	50	
To one years's cost of maintenance of Buoy Brig ...	3,839				1,000
To one year's cost of maintenance of Buoys (at the Hooghly rate) ...	600				10,897
		11,897			11,897
Excess in Annual Expenditure in present system in 2 years, 48 weeks ...	31,774		Saving in Annual Expenditure in proposed system in 2 years, 36 weeks ...	29,070	
Original outlay of present system ...	31,774		Original outlay of proposed system ...	29,070	
	63,548		Ditto recovered in 2 years, 36 weeks ...	00,000	

The cost and expenses, annual, of the Surveying Vessel have been purposely omitted, as it would appear equally in both systems.

E. E.,
(Signed) A. R. WESTON, *Captain.*

Appendix F.

From CAPTAIN H. HOWE, Deputy Master Attendant, in charge, to the Secretary to the Government of Bengal,—(No. 2576, dated the 24th October 1864.)

WITH reference to the last paragraph of my letter No. 2527A. of the 20th instant, I have the honor to submit that the present is a fitting time for the consideration of the question of substituting our Floating Light Ships by Light-houses erected on the foundation of Mitchell's Screw Piles.

2. To say nothing of the frequency with which our Light Ships have for years been driven from their Stations during heavy gales, and the great danger to which the crews are exposed on such occasions, as also the risks to ships making for the Station during the absence of the Floating Light, there is the present melancholy apprehension, now amounting almost to certainty, that the *Hope* has foundered, and the *Krishna* is yet missing.

3. The application of the Screw Pile to fixed Light-houses on sands, in localities exposed to the full action of the winds and waves in heavy storms, has, for several years, been successfully carried out on the coasts of England and Ireland.

4. These structures have generally been erected in shoal water, say in sixteen to seventeen feet, but the inventor has stated that he would have no hesitation in placing Screw Piles in depths of water of five or six fathoms, and would guarantee their success.

5. In 1838 a Light-house on this principle was erected, by direction of the Corporation of the Trinity House, on the Maplin Sand, at the mouth of the River Thames, where the channel was formerly marked by a Floating Light.

6. This is one of a series of lights for marking the Swin Channel, perhaps the most dangerous, most exposed, and most frequented of all the channels on the coast; all the east country craft and the greater portion of the coasting and collier vessels passing through this channel, while its liability and exposure to heavy storms is shewn by the numbers of colliers and other craft that are annually wrecked on the sands, or that founder in the channel during gales of wind in the winter season.

7. This Light-house, according to the evidence given by eminent Civil Engineers at a Judicial enquiry before the Privy Council, is fixed upon a bank of very loose sand covered by the sea, but the house has stood steadily, there being nothing for the water to strike against in comparison with the holding power of the screws at the bottom of the piles.* The tide rises upon the supports of this house sixteen feet.

* The nature of this screw was described in my letter No. 2527 A.

8. The foundation is composed of nine wrought iron piles twenty-six feet long and five inches in diameter, having a four feet (in diameter) screw at foot of each. The screws were sunk into the bank to the depth of twenty-two feet, leaving about four feet of the piles

out of the ground on which to secure the upper works. The work of sinking these piles into the ground* was completed in nine consecutive days.

* Which was done by means of powerful capstans fitted on a raft previously prepared.

9. A description of one of these Light-houses will serve for all, and sketches of two are annexed. I shall therefore proceed to enumerate some others that have been erected on different parts of the coast.

10. In 1839-40 the Fleetwood Light-house was erected in Morecombe Bay.

11. Morecombe Bay is described as the place of all others on the west coast of England most exposed, perhaps, to the tempest and the storm, but the vibration in this structure, during heavy gales, has been found to be so slight as not even to affect the going of a time-piece,† the reason was that the supports offered no resistance to the waves, though the tide rose on them at equinoctial springs to the height of thirty-two feet.

† In the Eddystone Light-house during heavy storms the vibration is so great that the rate of the time-pieces was affected.

12. In 1844 a Screw Pile Light-house was placed in Belfast Lough, Carrickfergus Bay, on the coast of Down.

13. In 1846 a large and important Beacon was placed between the Queen's and Prince's Channel leading into the Thames. It stands in a most exposed situation at the extremity of the Tongue Sand, in a depth at low water of seventeen feet.

14. Ccurtown Pier is another and remarkable structure built on the same principle.

15. It is erected on an open and exposed part of the coast of Wexford, a coast unprotected nearly from north to south with an open sea of seventy miles in front, while a surf of great height and force beats almost without intermission on the shore.

16. The above are sufficient proofs, without quoting further, that, as stated in the Phamplet from which my information is derived, and from which I have drawn largely in this letter, the system may be safely employed in any situation, however exposed to the action of the Sea, provided always that the ground is free from rock, and the principle was declared before the Privy Council to be especially applicable to quicksands.

17. Mr. Walker, the Consulting Engineer to the Corporation of the Trinity House, states his belief that Beacons or other structures erected upon Screw Piles would stand as well on the Goodwin Sands as on the Maplin and other places.

18. I have quoted all these facts and scientific opinions to prevent the possibility of a doubt arising as to the capability of a Screw Pile Light-house being erected on the sands or reef heads in our channels and withstanding the heavy Sea that prevails for months together at the Sandheads; the evidence afforded that Light-houses erected on the principle in question, in equally exposed situations, were as firm and substantial after ten years' continuance as when first erected, proves that they would be equally safe and substantial at the Sandheads.

19. I would therefore propose for consideration that Light-houses be erected on the edges of the channels in the room of the Lower Gasper Light Ship and the Light Ship at the Eastern Channel Station; the former to be the first undertaken, the situation possessing the greater facilities. I would also have said that the experiment might be first tried there, but there seems to be no need of experiment when the system has been tried, tested, and proved for upwards of twenty years, in tempest, sea, and surf, which are the exact characteristics of our Sandheads.

20. The Lower Gasper Light-house can be erected on the edge of the nearest sand in two and a half to two and three quarter fathoms low water, say fifteen to sixteen feet, the rise of the tide being twelve or thirteen feet spring tides; we have seen that in Morecombe Bay the tide rises thirty-two feet.

21. The exact position for this light is just on the eastern edge of the Gasper Sand, where it will answer as a guide for the Eastern Channel as well as the Gasper; and the light in this position will serve to mark the channel equally as well as the present Light Ship, while it will be infinitely more sure and constant

22. On this point I have consulted Mr. retired Branch Pilot Strevens, an Officer of great experience and talent, and the above is the conclusion arrived at, while he assures me at the same time that there is never any sensible change in the channel of the Lower Gasper; the Upper Gasper, it is feared, from its shifting nature and character, must continue, for a time at least, to be illuminated by a Floating Light until the practicability and facility of shifting and transplanting these structures, if desired, has been ascertained.

23. It is believed they can be easily removed and planted in another locality.

24. The Lower Floating Light is in eight and a half fathoms low water, and a Light-house can be erected on the reef in about the same latitude in six fathoms, the inventor, it will be remembered, having guaranteed to sink his piles with success in thirty-six feet.

25. It is believed that with a good floating station, and every preparation previously made, the piles for these Light-houses might be securely fixed in one fine weather season at the Sandheads, and after standing the test of the South-west Monsoon, the superstructure might be erected during the following season.

26. On the score of cost and annual expense, the comparison is altogether in favor of the Light-houses

27. That on Maplin Sand cost £3,350, of which the dioptric apparatus for lighting cost nearly £1,000; the only repair required in ten years was the occasional application of a little paint.

28. The annual expense of the Fleetwood Light-house in lighting materials and attendance is stated to be £335, while on the authority of Captain Washington, R. N., Inspector of Light-houses, the average annual expense of the Floating Lights of Great Britain is £1,316 each.

	Rs.	As.	P.
Block value ...	83,820	0	0
Yearly expense for Establishment, &c..	30,455	1	1

29. The cost of one Floating Light and the annual cost of maintenance is shewn in the margin.

30. I trust that the evidence I have submitted of the great superiority of the Screw Pile Light-house over Floating Light Ships, either as regards security, safety, permanency of position, and maintenance of light of the highest order, impossible to be obtained in a Light Ship, and lastly great saving in prime cost and annual expense, will be admitted by His Honor the Lieutenant-Governor as powerful arguments in favor of my recommendation, which I beg respectfully and earnestly to press upon His Honor's early and favorable consideration.

No. 4595.

COPY forwarded for the consideration of the President and Members of the Committee appointed to enquire into the adaptability of Screw Moorings to the circumstances of the Port of Calcutta, in continuation of No. 4594 of this date.

By Order of the Lieutenant-Governor of Bengal,

S. C. BAYLEY,
Junior Secy., Govt. of Bengal.

FORT WILLIAM,
The 29th October 1864.

Appendix G.

From ALFRED WELLS, ESQ. Superintendant of Government Pier Works, to the Secretary to the Government of India, Marine Department,—(datted the 19th October 1864.)

HAVING heard of the late destruction of many vessels at Calcutta, I have the honor in forwarding you a phamplet together with a Sheet of Patent Screw Piles and Moorings. The system of Patent Screw Moorings is becoming extensively used in England and abroad; each Mooring is calculated to bear a strain of four heavy ships; I have frequently seen twelve colliers made fast to one mooring in the River Thames when blowing a heavy gale of wind, and they have rode in perfect safety during the time, so that the holding power was very severely tested.

The price of No. 1 Mooring for soft ground is £24 each.

The price of No. 2 Mooring for hard ground is £30 each.

A complete set of screwing instruments for fixing Moorings is £140 per set. This price is free on board in England; should any Moorings be required, you will please address Mr. G. Wells, the sole Licensee and Manufacturer.

No. 5247.

Transferred to the Master Attandant for disposal.

By Order,

ARTHUR HOWELL,
Offg. Under-Secy., Govt. of India.

HOME DEPARTMENT;
Fort William,
The 9th November 1864.

Appendix H.

Calcutta, 10th November 1864.

The undersigned Members of the "Committee on Moorings," now sitting in Calcutta, examined this morning, on the part of the Committee, what were said to be No. 6 In-shore 2nd Class Moorings, Calcutta, and which the Harbour Master, Mr. Peterson, stated had been carried away bodily, anchor and all, to Cossipore, by the *Futteh Shah Allum*, of 820 tons, on the day of the gale of 5th October 1864.

The anchor was said to be 56 Cwt. It was two-fluked, but with the upper fluke bent down, thus differing from the 1st Class Mooring Anchors said to be 70 Cwt., which we saw in the Dock-yard, and which have only a single fluke.

The anchor and stock were, though old, in good order. A studded chain of $2\frac{3}{4}$ inches was shackled to the anchor ring, which was of $3\frac{3}{4}$ inches iron about 2′4″ in diameter, the shackle being of $4\frac{1}{8}$ inches iron. There was a shackle to the end of the $2\frac{3}{4}$ inches chain which had no pin; this shackle was termed No. 3, a pattern of which is before the Committee.

The shackles and chain were comparatively new, (the chain was marked 1845 on the stud,) and nothing was corroded, though the Moorings were said to have been down a long time. None of the parts of the Mooring, presented to us for inspection, had the appearance of having given in any way, but the whole of the Mooring was stated to have been lifted and carried bodily to Cossipore.

ALEX. FRASER, *Lieut-Col*, R. E.,
Supdt of Light-houses.

H. HOWE,
Depy. Master Attendant

Appendix I.

Statement of Examination, which took place this morning, the 12th November 1864, *of Chains and Posts forming the inside shore moorings of ships lying alongside the Esplanade off Calcutta, and Engine-house Moorings, and Nos.* 1 *to* 11 *Esplanade Moorings, on the part of the Calcutta Committee on Moorings by the following Members:—*

LIFUT. COLONEL A. FRASER, R. E.
CAPTAIN H. HOWE, *Deputy Master Attendant.*

1.—Engine-house Moorings, two ships,—*West* of 1,000 tons and *Great Tasmania.*

The post to which the Flood mooring chain was attached was perfectly good, and was said to have been received in 1858-59. The old post* was close by. The chain is 2 inches rubble chain—2 links $4\frac{1}{2}$ inches by $9\frac{1}{2}$ inches inside measurement; one of these links had parted.

2.—No. 1 Esplanade moorings—Steamers *Madras*† and *Bombay*, post all right. Ebb chain—2 inches stud and square—and $3\frac{1}{8}$ inches long link chain. This mooring was all right, the ring and shackle being there. The shackle of the Steamer's chain said to have parted, as there is nothing in the ring.

Flood chain and post carried bodily away.

3.—No. 2 Esplanade mooring post all right. Ebb chain parted a swivel, bolt drawn out or broken. Flood Post all right, flood chain all right, ship's stern chain (*William Fairbairn*) said to have parted.

4.—No. 3 Esplanade mooring in-shore—Ship *Clytemnestra.* Ebb Post all right, post chain ring parted; Flood Post all right, chain ring parted.

5.—No. 4 Esplanade mooring—Ship *Newcastle* inside. Ebb Post all right; Ebb chain ring lying broken on the bank.

Flood Post‡ (which was also the Ebb Post of No. 5 moorings) carried away bodily, chains and all.

6.—No. 5 Esplanade mooring—*Manilla*, the inside ship Ebb Post and chain as above.

Flood Post‖ all right, flood chain of $2\frac{1}{2}$ inches with inside chain of only 2 inches, but a link of the heavier chain parted.

* There were several old Posts along the line, which the Harbour Master stated he kept to attach Hawsers to.

† The ship first mentioned is the inside ship. There were only two in a Tier in the Esplanade moorings. The Ebb Post is that one holding a vessel's port bow—the Flood chain passing from the stern on the Port side and crossed.

‡ The Post may have broken off below, nothing, however, was to be seen of it.

‖ *St. Lawrence*, now lying in No. 5 with a stern scope of chain of about 80 fathoms, including 30 of her own.

7.—No. 6 Esplanade mooring. Ebb Post (carries also flood chain of No. 5 mooring) all right.

Ebb chain shackle* (which attaches the ring to the chain), called No. 3 shackle, parted.

Flood Post (which carries also Ebb chain of No. 7 and is said to have been new) carried bodily away, chains and all.

8.—No. 7 Esplanade moorings, Ebb Post as above.

Flood Post (which carries also Ebb chain of No. 8 mooring) all right. There was a pendant on this chain ring (why, is not explained), and the shackle (No. 3) parted, and ring and shackle of pendant both gone. There is a $1\frac{3}{4}$ inches chain inside the 2 inches chain which form the moorings.

9.—No. 8 Esplanade mooring, inside ship the *Govindpore*.

Ebb chain ring parted; shackle No. 3 at the end of the chain all right.

Flood Post and all carried away.

10.—Nos. 9 and 10 Esplanade moorings, owing to the length of the ships of the Company to which the *Mauritius* belongs, these two moorings were formed into one.

Ebb Post all right, chain ring parted.

Flood Post† all right, chain all right, ring all right; outside the ring was a piece of stud chain, 2 inches said to be, and one of the links of this latter chain had parted.

11.—No. 11 Esplanade mooring—single ship, the *Thunder*.

Ebb Post started about 3 feet forward, but not broken or out of the ground.

Ebb chain and ring all right, *Thunder's* chain (stud $1\frac{1}{2}$ inches) parted at the bending link, 15 fathoms from the Government ring proper.

Flood Post all right, with chain and ring.

A temporary Flood Post and mooring had been laid for the *Thunder*, for some purpose explained by the Harbour Master; it was all right, but the *Thunder's* stern chain of $1\frac{5}{8}$ inches stud had parted.

Appendix K.

Statement of Examination of the In-shore Moorings, Cooley Bazaar, by the Sub-Committee of the Calcutta Mooring Committee.

Calcutta, 15th November 1864.

No. 1, Ebb.—Post all right, chain all right, shackle and ring all right; the inside or post chain worn; it is said no vessel was moored here on the 5th October.

No. 1, Flood.—This is said to be all right; we could not see as it was covered up with road metal. The Troop hulk at the jetty was attached to this; she broke adrift, parting her own chain.

No. 2, Flood.—Post and all clean gone out of the heavy masonry footing.

No. 2, Ebb.—Clean gone, post and all; ship *Renown* lying on these moorings. Mr. Behrends, the Deputy Harbour Master, said that he was there at the time of the gale and that the *Renown* was the first to go and carried away the other vessels.

No. 3, Flood.—Ship's chain $1\frac{1}{2}$ inches (of the *Alum Shah*) parted, mooring $1\frac{5}{8}$ inches all right: a piece of Ship's chain on the ring; the ship said to be Arab.

No. 3, Ebb.—Above ship parted her own chain, $1\frac{1}{2}$ inches, at the link beyond the bending link, which, with the shackle, was shewn to us; inside chain of moorings much worn.

N. 4 A.—Flood post all right; 2 inches rubble inside, shackled with $3\frac{1}{4}$ inches square shackle to a $1\frac{7}{8}$ inches stud chain, chain worn but all right: there was no ship attached to this on the day of the gale.

New No. 4, Flood.—$1\frac{7}{8}$ inches chain's post all right; chain ring carried away.

New No. 4, Ebb.—Clean gone, post and all.

No. 4, Flood.—Post, long link $3\frac{1}{4}$ inches square chain, with 2 inches stud chain outside, ring of $3\frac{1}{4}$ inch iron, 2 inches shackle, all right.

No. 4, Ebb.—Post and all clean gone.

No. 5, Flood.—Inside length $1\frac{3}{4}$ inches twisted stud links, several studs gone; 2 inches stud chain outside ring all right; the *Gustave Louis* is said to have held on to this; no less than 5 ships in these moorings.

No. 5, Ebb.—Post started, but there inside chain, long link, to which we found shackled a much worn piece of 2-inch chain, one of the links of which had parted; this link had not, however, parted at the worst looking place, but at a flaw in the iron.

We remarked, generally, with reference to these moorings, that they were much worn in many places, and that the proportion of chains, links, and shackles were not well arranged, but we do not wish to convey the impression tha the moorings parted on account of these worn parts. It was stated, however, that but small ships were generally put in these moorings, though the *Romania*, which went ashore above Prinsep's Ghât, and was the ship in this tier, could not be called a small ship.

It will be seen from the above that the *Gustave Louis* held on throughout the gale to No. 5 flood mooring, though the ebb chain had parted. It would be instructive to know how the other four outside ships carried away.

Appendix L.

LOG OF THE *BROUGHTON HALL*,

Wednessday, 5th October 1864.

Begins with squally weather and heavy showers of rain, wind N. E. at 6 A. M.; turned the hands to work as usual, and washed decks at 7 A. M. The weather continuing very dark and threatening with rain, got the side ports lashed in and every thing secured about the decks; furled the awnings, and put preventive lashings on the stern moorings. At 9 A. M., the gale increasing gradually, got the best hawser on deck, to be ready in case of accident; noon—the gale increasing rapidly, and all appearance of a heavy Cyclone, Barometer falling fast. At 12 h. 15 m. the Steamer *Mauritius*, which was moored in-shore of us parted her starboard chain and swung against us, wind still increasing in heavy gusts, and constant rain. At 12-30 we parted our in-shore moorings on the port side, shortly afterwards, in a heavy gust, parted both moorings forward and swung

* This shackle is of $2\frac{1}{4}$ inches iron.

† This, regarding Flood mooring of *Mauritius*, was explained by the Harbour Master as follows:—Some two or three years ago the *Queen of the South* left a piece of 2 inches chain 60 fathoms long, which the Agents of the Company requested might be used as in-shore and Buoy chain, in addition to the regular Government mooring, for the purpose, we understand, of enabling the vessels of the Company to pick up the mooring more quickly. Mr. Peterson said that this chain had been always used by the ships of the Company with full knowledge. It is this chain (said to have been left by the *Queen of the South*) which has parted.

with the *Mauritius* athwart the river, until the stern moorings brought the ship up. At about 2 P. M. parted our stern moorings and drove before the wind athwart hawse of the ship *River Clyde*, her bowsprit coming foul of our mizzen rigging, the people of the *River Clyde* cut it and we drove clear of her. As soon as we parted our forward moorings we got our large hawser bent on to the port anchor, but we had not got it secured when the ship took the ground and heeled over very much and bumped heavy. The Steamer *Mauritius* still entangled with us at 4 P. M. The gale raging with hurricane fury, the ship *Western Star* was driven foul of us, carrying away our mizzen mast and all attached, the after house containing the Chief Mate's room, and one for the Captain, Lockers for flags and small stores of various kinds, together with spanker gaff and boom, &c. Same time, the *Mauritius* Steamer swung round bow on to us, and we drove up the river a considerable way until the *Mauritius* got entangled with the Ship *Newcastle*, and we got fast to the *Lady Palmerston*, where we remained aground. Finding the ship laying over on her beam ends and taking water in her side ports, cut away the royal, top-gallant and top-mast backstays, when all the top-masts and all attached, together with the fore-yard and jib-boom went over the side, and the ship righted considerably. We also find that, by the chafing and pitching of the *Western Star* against our stern and quarter, that the whole of the taffrail is carried away, that the steering apparatus and rudder are unshipped and rendered utterly useless, also that the port cathead and port anchor, with hawser attached, were carried away by the Steamer *Mauritius*. At 3 P. M. the gale moderating and veering to the southward of east; at 6 P. M. more moderate and wind veering to the westward, ship lying aground in soft mud; at 8 P. M. wind about west and moderate, with occasional fresh gusts, lying fast aground, without any motion; Carpenter and First Mate report 11 feet water, only, all round the ship. The Steamer *Mauritius* is lying inside of us on our port bow and grinding heavy against forecastle, and the *Western Star* is lying heavy on our starboard quarter. The *Lady Palmerston* is also lying in-shore of our port quarter, but we are clear of each other. Pumped ship at 30 inches at 8 p. m.

Appendix M.

Extract from Log of the Ship "Beaumaris Castle," October 5th 1864.

OCTOBER 5TH A. M.—First part dull and rainy, at daylight wind fresh at N. E., with heavy leaden appearance to S. E.; got all the awnings down and secured after breakfast; wind increasing, pointed all the yards to the wind, and the wind increasing at 11, blowing very hard, drawing to S. E. About noon a high "*Bore*," came up, and (S. S) *Mauritius* tore away her head shore moorings and fell across her outside ship, putting all the weight of both ships on our stern moorings; and as the wind increased they tore the moorings away by which we were held abaft, and the *Govindpore*, inside of us, tore her head shore moorings and fell on us, doing considerable damage. To save ourselves from being stove and sunk by her we slipped our stern bower cables, which held us together—the moorings being gone, we swung head to wind.

Bar. 29-95.
8 A. M., 29-85.
11—29-75.
Noon,—29-50.

Blowing a hurricane; the vessels ahead of us now breaking adrift,

1-30 P. M. drove down on us and forced us across the bows of a ship at her anchors; her bowsprit took our quarter and swept across our poop, carrying away all with it, destroying the skylight where my Barometer was hanging, and the wheel and steering apparatus, taking all the stanchions away round the stern, and her cables under our heel tore away the rudder, then we swung clear of her; but the *Hampden* and another ship drove across our bows and tore

2-30 P. M. us away with them. Letting go our port bower anchor we cleared them, but drove on shore on the Howrah side of the river. The Hurricane increasing in violence, drawing to S. S. E, we remained some time under the lee of several vessels stranded to the south of us, but tiers of ship came drifting and dashing against the ship below us, and then into us, tore us away, and we went drifting up the river, dashing into other vessels either aground or in the way, carrying away our fore-top-mast, top-gallant-masts, lower top-sail yards, main-top gallant-mast, jib and mizzen-booms, catheads

3-30 P. M. and bulwarks. At length, at about 3-30 to 4 P. M., we dashed among a number of stranded vessels at Cossipore and arrested our further upward course, and a number of other vessels driving up against us jammed us in on the bank, the vessels *Hindostan* and *Glen Isla*, on our bow and quarter, being deeper laden. We made our large hawser fast to the *Hindostan* to prevent being taken away again with the next flood; about six o'clock

6 P. M. it seemed to moderate and afterwards the sky got clear and was followed by a light W. S. W. wind and clear weather; sounded the pumps and found she was making no water. The Barometer being dashed down, no observations were of course made after about 1-30 P. M., when it appeared to be at 29-45.

JNO. ROBERTSON,
Commanding "Beaumaris Castle."

Appendix N.

Calcutta, 16th November 1864.

On the part of the Calcutta Mooring Committee, a piece of chain, being a part of the Government Bow Moorings of the *Newcastle*, was examined on board that ship this day.

A length of chain with ring and shackle and swivel attached to it, and about one fathom in length, was found shackled to the in-shore bow chain of the ship.

The ring of 3 inches iron was all right; the chain was 2½ inches stud.

A link or shackle attached to the swivel had parted, and in heaving in her own chain the *Newcastle* found the above attached to it.

Calcutta, 17th November 1864.

We examined, on this date, a set of moorings consisting of two first class mooring anchors with ground chains complete. They had been carried away bodily to the Howrah side and were lying close to the bottom of the wreck *Southampton*.

One anchor had a wooden spelttered stock, and the fluke of this was broken off and lying upwards; the other anchor had an iron stock and was complete; the chains appeared to be in good order.

H. Howe, *Deputy Master Attendant*
Alex. Fraser, *Lieut.-Col.*, R. E. } *Members of the Committee.*

Appendix O.

Report on the condition of the Mooring Posts and Chains from Chandpaul Ghât to Armenian Ghât.

No. 1, Calcutta Moorings.—Flood Post is broken off from the mason work, and the in-shore bridle chain carried along with the post. The Ebb Post is in good condition, the bridle chain and shackle are there, but the ring has parted and is lost.

2. No. 2, Calcutta Moorings.—Flood Post is all right and in good condition, the bridle chain, shackle and ring are all correct. The Ebb Post is old, and the bridle chain has parted about 2 fathoms from the post; the chain is 2 inches, and old.

3.—No. 3, Calcutta Moorings.—Flood Post is in good condition, the bridle chain, shackle and ring are all correct. The Ebb Post is also in good condition, the bridle chain is the old long link mooring chain, and the shackle and ring are there.

4.—No. 4, Calcutta Moorings.—Flood Post is in good condition, the bridle chain has parted about 3 fathoms from the post; the piece left is 2 inches English stud chain, and in good order. The Ebb bridle chain was made fast to a big tree at Bankshall Ghât, and parted by the ship *Harry Warren*.

5.—No. 1, Bankshall Moorings.—Flood Post is at present underneath the Hulk *Mattabangah* ashore. The ring and shackle are in good condition. The vessel's chain that was made fast to the ring parted. The Ebb Post is in good condition, the bridle chain, shackle and ring are all in good order, the vessel's chain parted from the ring.

6.—No. 2, Bankshall Moorings.—Flood Post is in good condition, the bridle chain, shackle and ring are all in good order. No vessel was lying there during the Cyclone. The Ebb Post is also in good condition, the bridle chains, shackle and ring are all in good order.

7. The in-shore moorings of new No. 3 and No. 4, Calcutta, were kept clear for the numerous cargo boats that go to and from the Custom House.

8.—No. 5, Calcutta Moorings.—Flood Post is in good condition, the bridle chain, shackle and ring are all in good order. The Inland vessels that occupied the in-shore moorings parted from the ring. The Ebb Post is old, the bridle chain, shackle and ring are all right and in good condition.

9.—No. 6, Calcutta Moorings.—Flood Post is in good condition, the bridle chain, shackle and ring are all in good order. The Ebb Post is old, the bridle chain, so far as it can be seen, is in good order. The Steamer *Nada* is lying on top of the chain.

10.—No. 7, Calcutta Moorings.—Flood Post is in good condition, the bridle chain is buried deep in the mud and used by Inland vessels occupying the in-shore berth.

11. The Ebb Post of No. 7, and Flood Post of No. 8, Calcutta Moorings, are buried in the mud far down alongside of Jessop's Wharf and cannot be got at. The Ebb Post of No. 8 is also covered up by the bank having been raised to a great height.

12.—No. 10, Calcutta Moorings.—Flood Post cannot be got at on account of the immense quantity of Government bricks piled upon the top of the Post and Chain. The Ebb Post is also covered by bricks belonging to the Municipal Commissioners, and also by broken cargo boats.

13.—No. 11, Calcutta Moorings.—Flood and Ebb Posts are also buried under broken cargo boats and stones.

Harbour Master's Office, *The 17th November* 1864. } J. F. Peterson, *Harbour Master.*

Appendix P.

Extract from Log of Ship "Winchester."

Wednesday, October 5th 1864.—Day-light, strong breeze, with hard squalls from the N. E. and heavy rain; at 8 A. M. wind increasing and every symptom of an approaching gale, Barometer 29-50.—Furled awnings and put preventer lashings on cables.

9 A. M.—Wind still increasing, and water getting much troubled, causing the ships to range and strain at their moorings very heavily.

10 A. M.—Wind blowing a furious gale. Seeing a probability of ship parting, unshackled the starboard bower chain abaft the windlass, bent it to the anchor and got chain on deck out of the locker, bent 11 inches hemp tow rope to port anchor, coiled rope down clear for running, and clenched end to the foremast, got starboard boat in board, battened down all hatches and closed lower deck scuttles. Barometer 29-15.

11 A. M.—Gale increasing and wind shifting more to the eastward, Ship *Newcastle* broke adrift forward and lay against our starboard side, her port cathead breaking in starboard bulwarks, bending chain plates, chafing laniards and carrying away guard boards of fore rigging. Barometer 28-90.

12-15 P. M.—Starboard bow chain broke adrift from the mooring. The two ships bringing port cable tight across the stem, broke cutwater, started stem knees, and did various damage to trail boards, &c. Figure head broken, and bobstay crane iron bent, and started by *Newcastle's* bowsprit.

12-30 A. M.—Parted port cable at ring of moorings, ship swung stern to wind. *Newcastle* drove clear, cutting our side very badly as she passed; tearing up guard boards, starting chain plates, and chafing laniards and rigging, smashed and carried away accommodation ladder, tore out boat's davit, and breaking poop rail; at the same time her yards fouled our braces, and running gear, cutting them all to pieces.

1 P. M.—Quarter deck and main deck awnings blew adrift in shreds. Wind at East, a frightful hurricane. Barometer 28-50.

1-30 P. M.—Let go both anchors under foot, veered tow rope, and 15 fathoms chain, overhauled 30 fathoms clear for running with check stoppers. Port stern mooring broke adrift.

2-30 P. M.—Saw a large ship drive across the Steamer *Thunder* and both ships came up athwart our chain a-stern, and brought away the mooring,

the *Thunder* striking the rudder, breaking starboard poop rail boomkin, and carrying away boom, guys and gear.

Veered tow rope to clench and starboard chain 60 fathoms, ship canted across when tow rope parted, and starboard anchor dragged, ship drifting fast up the river, at times lying quite down on her beam ends, then righting again as she came end on to the wind. Soon after, breaking adrift, came into collision with five other ships, breaking off port cathead, which dropped over board, forecastle stanchions and rail carried away, and breaking up guard boards of fore and main rigging, starting chain plates and badly chafing laniards and rigging in many places, and parting jib, guy, and smashing port-quarter boat. After some time swung clear and drove towards the left bank of the river, striking the bank several times and then driven furiously further on.

3-30 P. M.—Struck near the Chitpore Canal and was slowly blown over the ground till ship stopped by the Eastern Bengal Railway Jetty, where she remained; soon after the ship became fixed. The Ship *Tulja* came up and struck her on the port-quarter breaking in quarter gallery, poop rail, boomkin and warping chock, cutting up mizzen rigging, and laniards, parting top-gallant backstay, and carrying away mizzen top-gallant mast. Gale broke, and wind gradually subsided after 4 o'clock; at night when water left the ship she heeled over to port and settled down forward, leaving her stern high up on the bank.

At low water sounded and found 2¼ fathoms over the bow.

Found clogs of stern ports cut through, and plank ends and ports started. When port stern mooring broke adrift, starboard chain surged round mizzen mast to which they were made fast, tearing off all battens, and chafing mast.

G. L. GIDEON,
Commander.

Appendix Q.

Log of Ship "Moresfort."

TUESDAY 4TH OCTOBER A. M.—Fine and clear; P. M., unable to take in cargo, during the night dull and cloudy with heavy showers of rain; midnight wind from East, peculiar undulating swell, making the ships toss about, though calm. Sky overcast with heavy rain.

OCTOBER 5HT A. M.—Wet with heavy squalls at times, and every appearance of bad weather; furled awnings and prepared for a storm; 9-30 Bar. 29-40. In a terrific squall the *Simla's* port chain parted, also the stern chains of the Ship *Continental*, both ships being inside of us, therefore, throwing additional weight on the *Moresfort*, carrying away our port chain, which was immediately hove in and shackled on to the best bower anchor, we held for some time, until several other ships came drifting on to us, when we parted the other chain, we then cleared. In doing so, the *Simla* carried away our fore and upper fore top sail yards; we brought up safely in the river with best bower anchor, and the whole of the port chain 150 fathoms, holding very well, until the Ships *Solway*, *Red Rose*, and *Great Tasmania* came athwart with fearful crash and our chain cable broke.

Owing to the violence of the Cyclone, and drifting ships and collisions, the main-mast went by the board, carrying the mizzen top-mast and other small spars with it. During the whole time we were drifting towards the West side of the river, when, after considerable other damage sustained by collisions with other ships, we took the ground on Goosery Sand, about three miles from Calcutta, and laid quiet. Sounded round and found the ship on level ground; 10 P. M. better weather, hove in the starboard chain and shackled on second bower anchor to be ready, sounded pumps and found seven inches in the well.

During the violence of the storm the river was in a complete foam. Noon Bar. 29-26, 2-40 P. M. 28-55, 12 P. M. 9-230.

P. S.—When we hove, in our forward and stern moorings found part of the Government moorings fast to each chain.

Appendix R.

See Hon'ble J. N. Bullen's letter, to Secy. Govt. of Bengal, dated 28th Nov. 1864, page 573.

Appendix S.

From LIEUTENANT-COLONEL J. P. BEADLE, R. E., Secretary to the Government of Bengal in the Public Works Department,—(No. 5264, dated the 2nd November 1864.)

COPY of the following, with the three letters from Lieutenant-Colonel Fraser, and a Sketch, *in original*, forwarded to the Secretary to the Government of Bengal for consideration and orders.

2. The letter from the Government of India in the Public Works Department, No. $\frac{681C}{3916}$, of 19th August last, which is alluded to, has reference to a project for the construction of Wet Docks, &c., in this City, proposed to be carried out by the "*Calcutta Wet Docks and Wharves Company, Limited,*" whose application on the subject is in consideration in this Department.

Proceedings of His Excellency the Governor General of India in Council, Public Works Department,—(No. 0985C., dated the 27th October 1864.)

Improvement of the conveniences of the Port of Calcutta.

READ the three following letters from the Superintendent of Light-Houses on the subject of improving the conveniences of the Port of Calcutta by means of Quays, Jetties, Tramways, and Screw Moorings:—

No. 220C., dated 7th October 1864.
„ 221C., „ 10th „ „
„ 222C., „ 13th „ „

ORDER.—Ordered, that the foregoing papers be forwarded, in original, to the Government of Bengal for consideration, in connection with the general subject of the improvement of the Port of Calcutta, which is before the Lieutenant-Governor, (*vide* letter from the Government of India in the Public Works Department, No. $\frac{681C}{3916}$, dated 19th August 1864,) with the remark that Lieutenant-Colonel Fraser's suggestions as to Screw Moorings have already been forwarded for the consideration of Government in the Home (Marine) Department.

(Sd.) E. C. S. WILLIAMS, *Capt., R. E.,*
Under-Secy. to the Govt. of India,
Public Works Department.

From LIEUTENANT-COLONEL A. FRASER, R.E., Superintendent of Light-houses, to CAPTAIN E. C. S. WILLIAMS, R. E., Under-Secretary to the Government of India, Public Works Department,—(No. 220C., dated the 7th October 1864.)

I HAVE long thought it highly desirable that the style of moorings used for mooring the vessels in the river off Calcutta might be advantageously and economically altered, but have considered it useless to propose anything which would entail an expensive change, while there was nothing to support views likely to cause such cost.

2. Observing, however, the fatal effects of the late (5th October) Gale on the magnificent shipping in this river, and estimating the cost at which the disasters must be repaired, it is well worth enquiry as to how the vessels generally *parted* from their moorings, and as to whether an inprovement cannot be made in the method of such mooring by which the chances of safety to the ships may be much increased

3. I do not *exactly* know the system upon which the Calcutta moorings are laid down, but it is probable that more efficient moorings on the screw system might be gradually substituted at one-tenth of the cost.

4. There can be, I think, no doubt of the superior holding power of screws over every other description of mooring. It was stated, at a discussion at the Instiution of Civil Engineers in 1848 by Mr. Brooks, the Engineer of the Corporation of Newcastle-on-Tyne, that "the Corporation had purchased the right of putting down Screw Moorings in that river, and had carried the system out to a considerable extent. Genetal benefit was experienced by the increased facilities afforded for the shipping, and on the occasion of a very heavy storm which occurred, when nearly a thousand ships were wind-bound in the river, and the greatest consternation prevailed, not a single mooring gave way, although they were all fearfully tried, and not ten pounds worth of damage was done, whilst in the neighbouring port of Sunderland injury was sustained to the extent, he believed, of nearly thirty thousand pounds." Supposing the moorings to be in fault, we might congratulate ourselves indeed could the same thing have been said on the 5th of October 1864 of the moorings in Calcutta.

5. Screw Moorings might possibly be objected to where there was any chance of a heavy jerking sea, by which the hold in the ground might be loosened; but in a river like that at Calcutta, where the strain is constant, I am of opinion that no mooring can equal them whether for safety or economy of money and space. Captain Washington, R. N., wrote as follows to the Secretary of the Institution of Civil Engineers in 1848:—"I have also seen the Screw Moorings laid down in the Clyde both at Glasgow and at Greenock, in the Humber and the Tyne, and in all places have heard them well spoken of; those in the Tyne, I have reason to believe, have already saved some thousands of pounds worth of shipping from damage. As a sailor fully alive to the value of good ground tackle, I strongly recommend their use in all harbours in which space is an object, and in what harbour is it not?"

6. It is possible that such a hurricane as we had the day before yesterday may not occur again for many years, but it may occur again next year, and I think I have said enough at present to shew that there would be use in enquiry. The enquiry would be almost confined to three simple questions; *one at Home*,—"Do the advantages of the Screw Pile Moorings laid down within the last twenty years justify their use out here in lieu of the present moorings?" *Two in Calcutta*,—"Did the fixtures to which the mooring chains were fastened move?" or "Did the chains part?" If the former, Screw Moorings should be, without a doubt, substituted as soon as possible.

7. Bearing on the same subject I should be very much inclined, on the score of economy and certainty, to recommend fixed screw pile beacons for marking the channels generally in this river in lieu of the expensive buoys and moorings now used.

8. And lastly, I would notice a difficulty that has been noticed a hundred times before, but which I have not yet seen any attempt to overcome, and that is, the great want of facility in loading and unloading ships. Every one knows the cost and risk of the present mode, and now that so many hundreds of boats have been destroyed, the difficulty will be enhanced. I have heard the plan proposed of having floating piers like that at Liverpool, &c., &c., &c., but a good standing wharf will, for the purpose required, be better than any floating pier, for the simple reason that the floating pier is always at the same distance below the deck of a ship, whereas a standing pier is only at that distance at the top of high water, so that in one case where you have always to lift or lower through say twenty feet to load or unload a ship, in the other you have only to lift or lower through that distance at high water. Why not, therefore, build gradually a continuous screw pile wharf from Armenian Ghaut down to the Dock-yard, with projections to the side of every tier of ships and with a good tramway on the bank side. The expense would be comparatively small if built gradually on a general plan, and the returns on each one hundred feet done would probably pay in two years the next hundred feet. There is no doubt in my mind that this arrangement would wholly answer the purpose in view, while the small cost and early completion of any portion would bring in very large returns to complete the remainder, and eventually to form a large fund whereby a more permanent quay* might possibly be built.

* Or Wet Docks. see P. S. A. F.

P. S.—I am aware that Wet Docks have been proposed as a panacea for all evils likely to accrue to the shipping in the river, but it is hard to see that, with ships well moored, and the banks well quayed, we shall not obtain nearly all the advantages of Wet Docks at an expense which will not put an "incubus" on the trade for generations. And the arrangement I have proposed (paragraph 8), both facile and speedy, while benefiting all, will, as it seems to me, produce a revenue which hereafter will enable the City to build the Docks for such portion of the shipping as may require it.

From LIEUTENANT-COLONEL A. FRASER, R. E., Superintendent of Light-houses, to CAPTAIN E. C. S. WILLIAMS, R. E., Under-Secretary to the Government of India, Public Works Department,—(No. 221C., dated the 10th October 1864.)

IN continuation of my letter No. 220C., date 8th October 1864, regarding screw mooringd

screw pile beacons, and a screw pile wharf for the whole river frontage of Calcutta, I have the honor to state that, from the following calculations, it would seem to be worth the while of any Company or of the Municipality to undertake the wharf, and probably the moorings to.

2. The cost of a screw pile wharf four feet above high water mark, carried generally, say, to six feet of water at low water, with projections carried generally to eighteen feet of water at low water to the sides of vessels of ordinary tonnage and such projections finished off with bridges for the deepest ships, would certainly not cost more than from £40 to £50 a foot of river bank. Say, for illustration, the frontage extended three miles or 5,280 × 3 = 15,840 feet, the total cost would be say 15,840 × £50 = £792,000, or say £800,000. Say, with the increased facilities of discharging and loading a ship required to be fifteen days alongside, and, taking the extreme length of a ship at 300 feet, the wharf would take alongside 15,840 × 300 = say fifty ships every fifteen days or 100 Ships per month. Assume 800 tons as the average tonnage of the ships, and we have 100 × 12 × 800 × 2 = 19,20,000 tons as the quantity of goods loaded and unloaded per annum. Considering the saving of time (which is money) and risk, I do not suppose that 2 Rupees per ton would be considered heavy wharfage charge in comparison with the cost and risk of loading and unloading goods now incurred in boats. On this rough calculation the wharf would bring in 19,20,000 × 2 = 38,40,000 Rupees per annum as interest on the original outlay, and this is 48 per cent. Tolls on passengers on goods landed from Inland Steamers and Native Boats, which could all lie conveniently (without the chance of being crushed, as at present) in six feet of water, in the bays between the projections to eighteen feet of water, would far more than pay for repairs and maintenance.

3. The above calculations are more put forward to draw attention to the subject and have no pretence to strict accuracy, though I do not think they will be found very far wrong. I have not time to go into the cost of the wharf more then I have done, but it is easily done by any Engineer, and the other cal ulations can be put right by any Merchant.

4. As a part of the scheme, and as likely to be also remunerative, the tramway mentioned in my former letter should be formed running in the inner side of the wharf, but outside the ghâts from the Railway Station to the Government Dock-yard, the crossing at Tolly's Nullah being formed by a traversing bridge to allow of ingress and egress to boats, &c. Such a tramway would bring or take all goods from any part of the river bank, Turn Tables being given opposite each projection to eighteen feet water. The wharf need in no way interfere with bathing ghâts.

5. If this plan were adopted it would probably be more convenient that a double line of ships should be moored near the centre of the river, and moorings laid down along the wharf frontage for only a single line of vessels to load and unload, loaded ships going to sea giving place to others; and four or five of the projections (to eighteen feet of water) might be specially kept for sea-going steamers. Where perishable goods would be landed, the wharf would be covered in.

6. Supposing proper moorings be given, this plan would answer nearly all purposes of Wet Docks at probably a less expense without a doubt of its success, and with a certainty of quicker re-returns.

7. It would be best for the Municipality to undertake the work themselves. Half the work could be finished in three years, and the returns on the capital expended would enable the Municipality to get easily the remainder of the money, and eventually to devote the large returns, which may reasonably be expected, to other improvements. Fifteen lacs a year, for five years, would complete the work, and for the cost of every portion finished ample interest would be secured. But the work should be commenced on a general plan from the north, having eventually the entire river bank in view; and the tramway on the inside, and the screw moorings on the outside, should be carried south simultaneously with the wharf.

8. I may state, with reference to my former remarks on screw moorings, (letter No. 220C.,) that I see it stated that this system of mooring has been recently adopted by the Admiralty at Portsmouth and Holyhead; that the Thames Conservators have had an extensive system of them laid down; that they have been adopted in some of the principal harbours of the United Kingdom; and that they were employed "most satisfactorily" by the late Sir William Cubitt in mooring the large landing stage in the Mersey, at Liverpool.

9. Having forty or fifty distinct landing places and loading wharves for heavy and light craft for passengers and goods by steamers or ships, will also, as it seems to me, eliminate that element of dire confusion which now seems to disturb and obstruct the very important business, in a large commercial city, of loading and unloading ships at the river bank.

10. If the Government thought there was no impropriety in so doing, I would suggest that a copy of this and my former letter, No. 220C., be forwarded for opinion to the Chamber of Commerce.

Note.—From the Commercial Annual of 1864 I gather that the *external* trade of Bengal was as follows:—

	Vessels.	*Tonnage.*
Imports ...	1,376	917,102
Exports ...	1,279	882,166
Total ...	2,655	1,799,268

so that the calculations so far in the 2nd paragraph may well stand, for though I have put down 1,920,000 tons as the amount of tonnage upon which wharf dues would be chargeable, more than the difference would probably be obtained upon tonnage landed and embarked in the *internal* trade. I have not provided for a sufficient number of ships, for I have supposed only 1,200 ships to come alongside in the year, whereas the return shews 2,655 require to be accommodated; but I have averaged each ship at 300 feet long and of 800 tons, but ships of 300 feet in length are the exception, not the average, and smaller vessels would not take half the time alongside; this is a mere matter of detail not affecting the general question.

The value of Imports in 1863-64 was	Rupees	16,60,62,614
The value of Exports in 1863 64 was	Rupees	23,92,62,285
Total	„	40,53,24,899

and I have calculated Rupees 38,40,000 as the cost of putting the above value of Exports safely and quickly on *board*, and the above value of imports safely and quickly on *land*, and this is nearly 1 per cent. on the total value. The question seems to be therefore—Can the Merchant afford to pay for a safe, speedy, and efficient arrangement for loading and unloading his merchandize 1 per cent. instead of what he has to pay now for an unsafe, slow, and inefficient arrangement? And this is a question that the Merchant can best answer.

From LIEUTENANT-COLONEL A. FRASER, R. E., Superintendent of Light-houses, to CAPTAIN E. C. S. WILLIAMS, R. E., Under-Secretary to the Government of India, Public Works Department,—(No. 222C., dated the 13th October 1864.)

HAVING a Schedule of prices by Mr. Wells (who, I believe contracted to build the Madras Pier) of some of the iron-work required for a screw pile pier, and feeling that such arrangements as I proposed in my previous letters, Nos. 220C. and 221C., will, if carried out, be of great benefit to the community of Calcutta, I do not hesitate to forward to you a rough statement of the probable cost of properly accommodating ships (with a rough sketch of what I mean) as a verification of the rate I gave in my letter No. 221C. per running foot of river bank, *viz.*, £50.

2. I believe in the statement of cost I have *fully* provided for every thing, and on going more closely into it the result is more favorable than I at first thought.

3. From a more close, but still cursory view of the river bank, I do not think it will be necessary to run the general line of wharf beyond low water, as thence the bank drops very suddenly to deep water. I have therefore combined the general wharf and tramway, which, while not interfering (scarcely in any way) with existing arrangements, will give fifty-four feet more of strand road, and for nearly the same price (£800,000) as mentioned in my letter No. 221C., I am able to provide the means of putting goods on board ships from almost the doors of the godowns at (1) one per cent. on the value of the goods, while paying those who carry out the plan over (40) forty per cent. It is probable also that, in fixing the length of the projecting piers at 144 feet from low water, I have gone beyond what will actually be required, but I have done so with a view of being certainly on the safe side as regards cost.

See annexed Note on maintenance, &c.

4. The Government having allowed the Madras Pier to be built, which, though of considerable convenience, can scarcely ever pay, as no ship can go alongside, and therefore the cost of shipment into boats and landing from boats are not saved, I can scarcely suppose that they will not give consideration to a project which, as it seems to me on reasonable calculations, will certainly, if those calculations are *nearly* correct, re-pay itself in three years, while the piers are not exposed to any risk of destruction.

5. Besides the high percentage *directly* paid on this proposed outlay, it is perhaps scarcely necessary to point out the many ways it will pay *indirectly*, but I will mention one or two which are of importance. *First*—It will set free perhaps some 20,000 people now employed in dinghees, cargo boats, in loading and unloading them, in loading and unloading and driving hackeries, and numbers of artificers employed in building and repairing these boats and carriages, and direct their labour towards other branches of industry, and thereby cheapen the labor market. In a highly civilized country it may doubtless be a matter of consideration whether a number of laborers should be thrown out of employment in any particular branch; but in a country in a highly progressive state it must be of great advantage to reduce labor by improvement in one branch, and direct it to improvement in another. *Second*—It will probably reduce the time which vessels *need* to stay in this Port from forty to twenty days. *Third*—It will probably much reduce the Harbour Master's and River Police Establishments, and will certainly cause savings to the State in the Quarter-Master General, Army Commissariat, Ordnance Commissariat, and Customs Department, and finally the long line of well-lighted piers will add much to the appearance of the City and to the convenience and safety of its Inhabitants and Shipping.

6. There are, doubtless, proper sections, &c., already taken of the river bank with longitudinal levels, but if not, now is the time to do it, while the river side is unencumbered with ships, with a view of laying down a precise plan, and obtaining a precise estimate.

7. To those who would object to this screw pile scheme on the score of want of permanency, I would remark that it is the quickest way of accommodating the commerce of the Port, as well as the quickest way of getting a return for the money expended. If the work were placed in the hands of a "River Trust," the money gained would give funds at the rate of some 30 lacs of Rupees per anum wherewith either to form a permanent inside tramway, or a permanent outside quay-wall, while the screw pile platform would form the very best position from which to execute such works. The materials being ready, 300 feet of screw pile pier might be done per month, and every part done would bring immediate returns.

See Note on establishment, maintenance, and income accompanying.

8. In conclusion, therefore, I say that the arrangements I have sketched, *together* with proper screw moorings for the *entire* shipping ever

likely to be in the Port, could be carried out and laid down for, say, in round numbers, one million sterling, and that they would bring in a return of over 40 per cent after the lapse of five years. The best plan to raise the money would be for a "River Trust" to raise the money in the market in instalments of £200 000 per annum for five years on Debentures at an interest of say 6 per cent. with a currency of eight, seven, six, five and four years respectively, guaranteed on the Port Dues, and re-payable at the option of the "Trust" at the expiration of those periods. In eight years, then, from the commencement of the work, the "Trust" would be in a position to pay off its liabilities (taking into consideration returns in parts of the works intermediately finished) and have at its disposal, after deducting 10 per cent. for maintenance and repair, a yearly sum of at least 30 lacs of Rupees to take in hand (as in last paragraph) more permanent arrangements, while in the mean while it will have perfectly accommodated the shipping and the commerce generally of the Port. I include a Note of the probable ultimate cost of maintaining the pier and moorings, with a Memorandum of the probable savings on present mode of shipping and landing goods to complete the subject.

NOTE.—The enclosed Statement only includes Screw Moorings for ships alongside the wharf in detail, and merely a lump sum for the other moorings.

See annexed Note on maintenance and repairs, &c.

9. I should mention that the distance apart at which I have placed the screws for moorings in the Sketch is subject to correction.

P. S.—Should this project be thought worthy of consideration by His Excellency the Viceroy, I would request that my previous letters, Nos. 220C. and 221C., with this and its accompaniments, might be printed together as shewing the entire plan proposed by me.

Statement of work to be done and cost, to accompany Lieutenant-Colonel Fraser's letter No. 222C. of the 13th October 1864.

THE work to be done according to the accompanying Sketch is as follows:—

1. To build a facing wall along the whole left bank of the river where required at about three-quarters flood tide from the Railway Station to the Government Dock-yard, with masonry back projections opposite each pier to receive the two-inch tie-rods connecting the piles forming the piers.

2. To fill in behind this wall level with the top, which is to be four feet above high-water mark, spring tides.

3. At fifteen feet from the face of this wall to run a line of piles six inches diameter, screwed into the ground with Mitchell's screws. This line of piles to be connected with the wall and with each other (except the wall connections opposite the piers, which will be of two-inch iron) by diagonal one and a half inch rod iron traces.

4. At twelve feet from the first row of piles a second row to run twelve feet from the last, and connected with each other and the first line in like manner.

5. At twelve feet from the second line a third row of piles connected in a similar manner.

6. At fifteen feet from the third line a fourth row of piles connected in a similiar manner.

7. Commencing at a convenient spot near the Railway Station on left bank to run out at convenient intervals, not exceeding 300 feet from centre to centre, screw pile piers averaging 144 feet long by 48 broad, consisting of piles eight inches diameter of from thirty to fifty feet long with Mitchell's screws having (where necessary) the patent saw edges. Five lines of piles twelve feet apart, connected together longitudinally and transversely with two-inch rod iron diagonal braces, and the two outer bays further braced and shutted by T. iron braces at the level of low water. Each pier to be finished off with Teak Timber Fender Piles 12" × 12."

8. The heads of the piles to be arranged with iron caps to receive Teak Timber girders, over which Teak joists, and the whole finished off with three-inch planking one inch apart. Railings of four-inch standard with three-inch diagonal bracing, foot and hand rail to be given; steps of open cast iron-work to be given as per Sketch.

9. The inner half (seventy-two feet) of each pier to be covered in lightly with corrugated iron pitched roofs for the protection of perishable goods, for Police Stations, and Toll Collectors.

10. The piers and tramway to be lighted with gas, and pipes to be laid along the piers in connection with the Town water-supply (when in existence) for watering ships.

11. Along the whole length of the centre bays of the piers and wharf a double line of tramway of the Indian Railway gauge to be given. My calculation shews that 100 tons per diem will be loaded and unloaded at each pier, take each truck to carry on an average three tons, and to make six trips per diem, six up and six down, we shall require six (6) trucks to each pier, or 300 trucks for goods. Sidings to be given at convenient places. The tramway turn-tables to be given opposite each pier to turn the trucks on to the piers. Standing and movable cranes to be given at convenient places. It is well to have the tramways on the piers on the *inner* bays, while the movable cranes run upon rails on the *outer* halves (seventy-two feet) of the piers to pick up all goods from boats, &c., as well as from ships.

12. Between the piers, and simultaneously with their construction, Screw Moorings to be laid on the plan shewn roughly in the Sketch.

Propable Cost of the above.

	£.	£.	
For Tramway 15,840 feet long × 54 feet broad, four sets of 6-inch Piles 15 feet apart longitudinally, at an average of 25 feet long each.			
4,224 Piles × 25 feet long each × 66 (= weight in lbs. of a lineal foot) = 62,230 cwt., at 20*s.* per cwt., including screws	62,230		
For fifty Piers, averaging 144 feet long × 48 feet broad, five rows of 8-inch diameter piles 12 feet apart and of an average length of 40 feet = 60 × 50 × 40 × 96 (= weight in lbs. of a lineal foot) = 103,000 cwt., at 20*s.* per cwt., including screws ...	103,000		It would probably be cheaper to give iron tubular girders altogether.
1,000 tons of Pile caps, nuts, bolts, screws, and boxes, at £20 a ton	60,000		
124 200 (lineal feet) × 10½ (weight of a lineal foot in lbs.) = 1,304,100 lbs. = 600 tons of 2-inch wrought iron rods, at £18 a ton	10,800		
$\frac{278,784 \div 15}{20}$ = 929 tons of 1½-inch rod iron, at £18 a ton	16,722		
		252,752	
50 Instruments for screwing down Piles, at £50 each	2,500	2,500	
470 tons of nails for tram and cranes, at £.0 per ton	4,700	4.700	
300 Trucks, at £30 each	9,000	9,000	
100 Movable Cranes, at £40 each	4,000	4,000	
Gas Lamp Posts, corrugated iron roofing, steps, rope, chain, guy screws, sheers, &c., and a couple of Portable Engines for screwing piles	10,000	10,000	
Teak Timber Platform			
For Tramway 15,840 × 54 = 855,360 square feet.			
For Piers 50 × 144 × 48 = 345,600 „ „			
Total 1,200,960 „ „			
at £15 per 100 feet	180,135		This includes timber girders and joists, and though I have great faith in the useful resistance of timber to concussion, iron may be cheaper.
1,808 tons of Fender Piles 12 inch × 12 inch, at £6 per ton	10,800		
500 tons of Sleepers for Rails (longitudinal) at £6 per ton	3,000		
Total Timber from Moulmein ...	.....	193,935	
950,400 cubic feet of masonry in a wall, say 12 × 5 × 15,840, for facing with here and there piling, at £5 per 100 cubic feet	28,512		
90,000 cubic feet of masonry in back projections to receive 2-inch tie-rods, at £3 per 100 cubic feet ...	2,700		
Total of Masonry ...	.....	31,212	There would probably be much saving in these items.
3,168,000 cubic feet of earth-work in filling in behind wall, at 3*s.* per 100 cubic feet	4,752		
Total of Earth-work ...	.....	4,752	
FREIGHT AND INSURANCE.			
3,112 tons of 6-inch Piles 5,150 „ of 8 „ 3,000 „ of caps, &c. 600 „ of 2-inch rod iron 929 „ of 1½-inch rod iron 470 „ of Rails } From England. 10,000 „ of Timber from Moulmein. 500 „ of Apparatus, &c., from England.			
23 761 tons, at £3-10*s.* per ton, including loading and unloading	83,164		This is probably an outside rate for freight, &c., &c.
Total Freight Insurance, &c., &c. ...	.....	83,164	
Carried over ...	.....	£596,015	

	£.	£	
Brought forward ...	.....	£596,015	
LABOR.			
On an average twenty men will screw down a Pile a day with plenty to spare ∴ 7,224 × 20 = 144,480 men, at 1*s.* each, including Sirdars, &c. ...	7,224		
Fitting Tie-rods, &c.	1,000		
,, Rails, &c.	1,000		
Other labor (the platform is calculated at £15 per 100, including labor) including fixing Fender Piles ...	5,000		
Total of Labor	.....	14,224	
Grand Total, Labor and Materials ...	.....	610,239	
ESTABLISHMENT.			
1 Small Steamer to attend the works	15,000		This Steamer will not be constantly employed, and when not so, she can earn money as a Tug.
8 Cargo Boats, with a Boat each, at £1,000 each ...	8,000		
Establishment of Steamer, at £200 a month, for five years	12,000		It is probable the whole project would *not* take five years to carry out. At all events the *whole* of this Establishment would not be required during the first and last years.
Establishment of eight Cargo Boats, at £80 a month, for five years	4,800		
Directing Engineer, at £200 a month, for five years...	12,000		
Two Executive Engineers, at £100 a month each, for five years	12,000		
Four European Subordinates, at £20 each per month, for five years	4,800		
Four Native Subordinates, at £10 each per month, for five years	2,400		
Office Clerks, Writers, Peons, and Stationery, at £200 a month	12,000		
House and Ground Rent, at £400 a month ...	24,000		
		107,000	
		717,239	
Add Contingencies and things unforeseen, at 10 per cent.	.....	71,724	
Grand Total for Piers and Tramway ...	.....	788,963	
RATE OF COST OF SCREW MOORINGS.			
400—12 cwt. Screws, at £25 each ...	10,000		
100 sets of Buoys and Chains, at £400 each ...	40,000		
6 Ditto Screwing Instruments, at £150 ...	900		
N. B.—The crew of Steamer and Cargo Boats could screw these down	50,900		
Contingencies at 10 per cent. ...	5,090		
		55,990	
Total for Piers, Tramway, and Moorings for Ships alongside the Piers ...	.....	844,953	
Add for other Moorings	.....	155,047	
Total for the accommodation of the whole of the Shipping and Commerce in the Port of Calcutta	.....	1,000,000	

CALCUTTA,
The 13th October 1864.

A. FRASER, *Lieut.-Col.*, R. E.

From LIEUTENANT-COLONEL A. FRASER, R. E., Superintendent of Light-houses, to CAPTAIN E. C. S. WILLIAMS, R. E., Under-Secretary to the Government of India, Public Works Department,—(dated the 19th October 1864.)

I MADE a mistake in my *Note* of Establishment for Tramways, &c., which accompanied my letter No. 222 C, and which I altered in the detail and not in the totals at the end of the Note. Would you kindly correct this for me.*

* Correction made.

I don't know whether the information about Government of India having decided upon going in for Jetties was intended to stop my plan, but it is easy to shew that you *can't* build Jetties without a Tramway, or a Tramway without Jetties with any useful effect.

1. You known that the chief Godowns of this Port are situated at the *end* (the north) of a long line of ships moored along the bank, and that this distance (south) is three miles. That Jetties should be generally useful, you *must* build them along the *whole* line at the distance apart of a ship's length. You thus increase the principal cost of shipping goods, *i. e., land carriage on ordinary roads*, and it would be easy to shew that the shipper would gain very little by this arrangement, while you merely produce the confusion now taking place opposite the Godowns above along the whole of the Strand and Course.

2. A Tramway without Jetties would not pay, because it would never be used, as it would merely add the cost of conveyance along the Tramroad to the cost of present boat hire, which, I imagine, varies but little at any point of the River bank within the three miles.

It seems to me therefore you *must* go in for the combination of the line as I have proposed, and which is at least comprehensive. You can't have *solid* Jetties as the Bays would silt up, and of others none are equal in permanence and celerity of construction to Screw Piles.

I wish I had mentioned the points (noted in 1 and 2 above) in my letter, but in laying it before Government you can do so for me should the Government be inclined to give consideration to the matter.

P. S.—By adopting my proposed arrangements you settle the *whole* River question at once; any partial arrangements are to my mind to be avoided.

Note of the probable Cost of maintaining the Wharves, Jetties, Tramways, and Moorings proposed in Lieutenant-Colonel Fraser's letter No. 222C. of 13th October 1864.

	Rupees per annum.	Total.
1.—*Police Establishment.*		
1 European Constable, at Rs. 100 per month	1,200	
1 Jemadar, „ „ 25 „	300	
25 Peons, „ „ 6 each „	1,800	
1 Boat and Crew „ „ 100 „	1,200	
Total Police, Rs. ...	.....	4,500
2.—*Conservancy Establishment.*		
2 Tindals, at Rs. 10 each per month...	240	
50 Topazes, „ 5 „ „	3,000	
1 Boat and Crew „ 100 „ „	1,200	
Total Conservancy, Rs. ...	.....	4,440
3.—*Toll Collecting Establishment.*		
All steps down to the River from the Bays should be free for passengers and light goods; all steps down the Pier sides, and all passengers and goods along the Jetties to the ships should pay Toll.		
To each Pier one Collector of Tolls and Register of goods passed would be necessary, giving security of Rs. 1,000.		
50 Collectors, at Rs. 50 each per mensem	30,000	
5 Daily Bill preparers for goods passed to and fro by Registering Collectors, at Rs. 75 each per month	4,500	
Total Toll Collecting, Rs. ...	.....	34,500
4.—*Tramway Establishment.*		
As Coolies would be required for cranes for loading and unloading, it is probably best to do the whole work by manual labor.		
5 European Overseers, with ten Piers and sixty Trucks in the charge of each, at Rs. 100 each per month	6,000	
These Overseers shall also keep a daily Register of goods loaded and unloaded in and from their Trucks to check the Native Collectors.		
5 Coolie Sirdars, at Rs. 10 each per month	600	
6 Ditto to each of 300 Trucks, 1,800 coolies, at Rs. 6 each per month ...	1,29,600	
Total Tramway Establishment, Rs. ...	.....	1,36,200
Carried over ..	.....	1,79,640

	Rupees per annum.	Total.
Brought forward ...	.....	1,79,640
5.—*Harbour Master's Establishment.*		
1 Steamer, interest on her value (£15,000), at 6 per cent	9,000	
25 Boats of three classes, at £1,000 each, with small Boats, interest, on Rs. 2,50,000, at 6 per cent.	15,000	
2 Gigs, at £80, interest at Rs. 6 per cent., on Rs. 1,600	96	
Establishment of Steamer and Coal, at Rs. 3,000 a month	36,000	
Ditto of 25 Boats, averaging Rs. 100 a month	30,000	
25 Assistant Harbour Masters, in three classes, averaging Rs. 300 a month each	90,000	
Establishment for (2) two Gigs, six-oared	1,800	
Total Harbour Master's Establishment, Rs. ...	.....	1,81,896
6.—*General Establishment.*		
The Secretary, Superintendent, and Engineer, at Rs. 2,000 per month ...	24,000	
1 Ditto ditto Wharf Master, „ 1,000 „ ...	12,000	
1 Ditto ditto Harbour Master, „ 800 „ ...	9,600	
1 Cashier, giving Rs. 20,000 security, „ 200 „ ...	2,400	
		48,000
7.—*Office.*		
1 Register, at Rs. 400 per month	4,800	
1 Checking Clerk to check the Registers of Wharf Overseers and Toll Collectors, at Rs. 350 per month	4,200	
1 General Clerk for Secretary and Superintendent, at Rs. 300 per month ...	3,600	
1 Ditto ditto ditto at „ 200 „ ...	2,400	
2 General Clerks for Superintendent, at Rs. 200 each per month... ...	4,800	
1 Wharf Master's Clerk, at Rs. 200 per month	2,400	
1 Harbour Master's „ „ 200 „	2,400	
Office rent, at Rs. 500 a month	6,000	
		30,600
Grand Total per annum, Rs. ...	.....	4,40,136
Abstract.		
1.—Police	4,500	
2.—Conservancy	4,440	
3.—Toll Collecting	34,500	
4.—Tramway Establishment	1,36,200	
5.—Harbour Master's Establishment	1,81,896	
6.—General Establishment	48,000	
7.—Office	30,600	
	4,40,136	
Contingencies, at Rs. 10 per cent. ...	44,014	44,014
Grand Total per annum, Rs. ..	4,84,150	4,84,150

	Rs.	Rs.
Taking therefore 20,00,000 tons of goods landed and shipped, a charge of Rs. 2 per ton as the *sole* charge to be made against a ship while in Port, *except* for light dues and pilotage, would bring in a gross income to a "Trust" of, per annum - -		40,00,000
Deduct for Establishment -	5,00,000	
„ repairs, renewals, and wear and tear -	5,00,000	10,00,000
Balance clear profit per annum ...		30,00,000
N. B.—The actual amount of *Imports* of *Merchandize* for the year 1863-64 was in value - ...		11,08,63,281
And of Treasure - ...		5,51,99,333
Total, Rs. - ...		16,60,62,614

The actual amount of *Import* tonnage was 9,17,102 tons, ∴ the mean value of a ton of goods imported was $= \frac{11,08,63,281}{9,17,102} =$ Rs. 121

The actual amount of *Exports* of *Merchandize* for the year 1863-64 was in value - ...	20,94,69,119
And of Treasure - ...	2,97,93,166
Total, Rs. - ...	23,92,62,285

The actual amount of *Export* tonnage for 1863-64 was Rupees 8,82,166, ∴ the mean value of a ton of *Merchandize exported* was $= \frac{20,94,69,119}{8,82,166} =$ Rs. 240.

∴ The mean value of a ton of Export and Import *Merchandize* $= \frac{240 + 121}{2} =$ Rs. 180 nearly.

I have proposed Rupees 2 per ton. The questions seems to be resolved into, can the Merchant pay 1¾ per ton, or about ·9 per cent. on the value of his goods on the *average* (of course some goods would pay more and some less)? and will the charge on the "Treasure" make up the remaining ¼ per ton on the difference between 8,82,166, 9,17,102=17,99,268 (the actual Import and Export tonnage) and the 2,000,000 tons upon which I have calculated as paying labor dues and wharfage at Rupees 2 per ton?

If these questions are answered affirmatively, then I say, what with the internal commerce and tolls on passengers besides, the scheme will pay the "Trust" over 40 per cent., which is a very large margin of profit.

Memorandum.

I conclude this paper with a Memorandum of the probable cost of the present mode of shipping goods which I obtained from Major Willes, Deputy Commissary General.

	Rs.	As.	P.
1. The average cost per ton (taking light and heavy goods together) of carriage by hackery in Calcutta per mile is - - -	1	11	0
(Of this the shipper and receiver of goods would save by the Tramway from 4 annas to 8 annas per ton.)			
2. The average cost per ton (taking as above) of boat hire from River bank to ship's side is - -	2	0	0
(Of this the shipper would save Rupees 2 per ton.)			
3. The averave cost per ton (taking as above) of lifting goods from a hackery on the River bank into a boat at the River side - -	1	11	0
(Of this the shipper would save Rupees 1-11.)			
4. From another source I learn that the cost of lifting a ton of goods from a boat into a ship is about per ton - - -	0	4	0
(Of this the shipper would save 4 annas.)			
5. I assume myself that a ship does not pay less than (per ton) for Harbour Masters and Moorings -	0	4	0
Total now paid per ton -	5	14	0

Hence it would appear that by paying a tonnage due of Rupees 2 per ton for the Tramway, Piers, Wharf, and Moorings, and all other Port dues, the shippers and receivers of goods and owners of ships would *save* over Rupees 2 per ton, which is another large margin of profit. So that it is probable that a tonnage due of Rupees 2-8 per ton, while very profitable to trade, would meet all Harbour dues, all Light dues, and all other dues necessary to keep the River from Calcutta to its mouth in the most perfect order possible, and while giving to the shipping the most perfect accommodation, would give an extraordinary profit to the "Trust" which undertakes the arrangements.

P. S.—Private Wharves, such as the Peninsular and Oriental Company's, &c., should either be joined on to the general arrangements and compensation given, or should be separately taxed.

A. Fraser, *Lieut.-Col.*, R. E.

Calcutta,
The 13th October 1864.

No. 4771.

Copy forwarded for the consideration of the Committee appointed to enquire into the adaptability of Screw Moorings to the circumstances of the Port of Calcutta, with a request that these papers may be returned with the Committee's Report.

By Order of the Lieutenant-Governor of Bengal,

S. C. Bayley,
Junior Secy., to Govt. of Bengal.

Fort William,
The 4th November 1864.

Appendix T.

From Captain E. C. S. Williams, R. E., Under-Secretary to the Government of India, Public Works Department,—(No. $\frac{994}{2330}$C., dated the 12th November 1864.)

Transferred to the Government of Bengal for consideration.

From Lieutenant-Colonel A. Fraser, R. E., Superintendent of Light-houses, to Captain E. C. S. Williams, R. E., Under-Secretary to the Government of India, Public Works Department,—(No 261, dated the 29th October 1864.)

Adverting to the correspondence which has taken place on the subject of Light-houses on Screw Piles, and which has resulted in the Government of Indiahaving requested one to be sent out for the Straits of Malacca to take up the position of the present Light Ship *Torch*, and I being ordered to survey and report upon sites for three others on the coasts of British Burmah, one being at the mouth of the Rangoon River in lieu of the present Light Ship, a second on the Baragon Flat, and a third on or inside the Oyster Reef off Akyab; and adverting, especially to the last paragraph of my letter No. 528, dated 14th March 1864, in which I stated that the lights at the entrance of the Calcutta River were quite inadequate to the wants of the trade; and observing that the late gales have again proved that Light Ships are in no way to be depended upon for certainty of light, while in original cost they are probably as expensive as Light-houses on Screw Piles, and trebly costly in maintenance and very inferior as regards the power of showing a good light, I have the honor again to bring to the notice of the Government of India the value of Light-houses when they can be built on Screw Piles over Light Ships, with a view to the substitution of the former for the latter at the Sandheads should a survey prove it to be practicable; and with this object I would recommend that the range of surveys and experiments I propose to undertake under the orders of Government as communicated in Colonel Strachey's No. $\frac{401}{3}$C.,

Public Works Department No. 38, dated 26th May 1864, to the Right Hon'ble the Secretary of State for India, from the Government of India, in the Public Works Department.

Proceedings, Governor General of India in Council, No. 049C. of 23rd April 1864, and Secretary, Public Works Deprrtment's letter No. $\frac{333}{3}$C., dated 15th July 1864, and Proceedings, Governor General in Council, No. $\frac{333}{3}$C., dated 27th May 1864.

dated 15th July 1864, and No. $\frac{317}{3553}$C., dated 15th June 1864, be extended to the Sandheads.

2. You will observe that I do not commit myself to the opinion that it *is* practicable to substitute Light-houses on Screw Piles for the Light Ships at the Sandheads, but the present system of lighting, as I have thrice before brought to the notice of the Government, is, as I think, capable of improvement and it is well worth while going to the small expense of surveying, &c., to endeavor to ascertain the practicability or otherwise of introducing a mode of lighting in fixed Light-houses so immeasurably superior.

No. 5155.

COPY forwarded for the consideration of the President and Members of the Committee appointed to enquire into the adaptability of Screw Moorings to the circumstances of the Port of Calcutta, in continuation of endorsement No. 4595, dated the 29th ultimo.

By Order of the Lieutenant-Governor of Bengal,

S. C. BAYLEY,
Junior Secretary to the Govt. of Bengal.

FORT WILLIAM,
The 22nd November 1864.

Appendix U.

Estimate of Materials for a Single Set of Fixed Moorings.

Number and Quantity.	ARTICLES.	Valuation. Rs.	As.	P.
2	Two Anchors of 70 Cwt. each ...	1,820	0	0
2	Two ditto backing of 20 Cwt. each	200	0	0
16	Sixteen Fathoms of 2¾ inches chain	624	0	0
40	Forty ditto of 2 „ bridle chain ...	775	0	0
32	Thirty-two ditto of 1¼ „ backing chain ...	620	0	0
2	Two No. 1 Shackles ...	42	0	0
2	Two No. 2 ditto ...	34	0	0
10	Ten No. 3 ditto ...	130	0	0
6	Six No. 4 ditto ...	30	0	0
2	Two No. 4 Buoy Swivels ...	30	10	8
6	Six No. 1 Rings ...	66	0	0
2	Two 2nd Class Iron Buoys ...	980	0	0
2	Two Buoy Pendants of 2 inches chain of 2 Fathoms each ...	76	6	0
40	Forty fathoms of 2 inches chain for in-shore bridle ...	775	0	0
2	Two Posts each of 22 feet long and 2 feet square ...	50	0	0
	Total Rupees ...	6,253	0	8

HARBOUR MASTER'S OFFICE,
The 2nd November 1864.

J. F. PETERSON,
Harbour Master.

Appendix V.

Memorandum of the method adopted in laying down Moorings in the Port of Calcutta.

Supposing a double set of first class Moorings, *i. e.*, for 2 ships to be ordered to be laid off the Esplanade in 6 fathoms low water, the course would be as follows:—

I measure off my distance from the upper part of Baboo Ghât as a starting point to the lower part, and mark it with a small buoy. I then measure off and mark my distance from the shore from low water-mark, say about 25 fathoms where I intend to place my first set of moorings, consisting of one large anchor of 70 Cwt. and a small backing anchor of 18 to 20 Cwt. with a chain 15 to 25 fathoms 1¼ to keep the moorings in their place.

To the heavy anchor there are attached 8 fathoms of 2¾ inches chain called the ground chain, and 20 to 24 fathoms of 2 inches chain; at the end of this is a No. 3 shackle to receive a large ring of 3¼ inches iron for the pendant to be shackled to.

The pendants consist each of two fathoms of 2 inches chain with a No. 3 shackle and another large ring, to which the ship's chain is shackled on.

The length of the ship's chain from the hawse pipe to the mooring ring is generally from 10 to 15 fathoms. The buoy for keeping the mooring ring up, is secured to the ring by a No. 3 shackle, a No. 4 buoy swivel and a No. 4 shackle to the buoy.

The outer or second set is laid down in precisely the same manner at a distance of about 15 fathoms apart.

There is also a large post sunk well up on the bank 22 feet long and 2 feet square, to which is secured a 2-inches chain 40 fathoms long, at the end of which is a No. 3 shackle and a No. 1 ring to which the in-shore chain from the ship is fastened.

J. F. PETERSON,
Harbour Master.

Appendix W.

Number of times that the Light ships have gone adrift in gales of wind or from other causes during the last 10 *years.*

Date of report.	Vessels' names.	REMARKS.
1855.		
April 21st ...	Hope ...	Driven from her position.
1856.		
Sept. 7th ...	Ditto ...	Cable parted.
1857.		
April 23rd ...	Ditto ...	Loss of anchors.
1858.		
April 21st ...	Star ...	Parted from her anchors.
June 17th ...	Comet ...	Loss of anchors and parting of cables.
Oct. 28th ...	Star ...	Blown off from her station.
1860.		
July 27th ...	Lower Gasper L. V. ...	Blown from her station.
1861.		
March 10th..	Hope ...	Loss of anchors.
Oct. 8th ...	Ditto ...	Loss of anchors.
1862.		
July 29th ...	Star ...	Loss of bower anchors and 50 fathoms of chain.
1864.		
April 4th ...	Comet ...	Loss of anchors.
July 27th ...	Ditto ...	Driven fom her position.
August 3rd...	Ditto ...	Drifted from her station.
Oct. 4th ...	Krishna ...	Drifted and lost.
„ 5th ...	Hope ...	Drifted and lost.
„ 5th ...	Star ...	Drifted over to Balasore and dismasted.
„ 9th ...	Comet ...	Driven from her station.
„ 23rd ...	Outer F. L. V...	Driven from her position.

S. G. BOON, *Captain.*
Asst. Master Attendant.

The 4th January 1865.

Appendix X.

From A. B. Clapperton, Esq., Officiating Master Attendant, to C. B. Greenlaw, Esq., Secretary to the Marine Board,—(No. 1, dated the 1st September 1842.)

In continuation of my letter No. 125, dated the 20th June last, I have now to submit, in compliance with the orders of the Marine Board,* the accompaying Statements† from the Harbour Master of the names and tonnage of all the vessels at the Hon'ble Company's moorings during the gale of June last, specifying those that broke adrift, with the particular mooring parted from, and the cause of parting as far as has been ascertained; showing also the weight of the mooring anchors, and size of chain where known, and state of preparation in which each vessel was, at the time, to withstand the fury of the gale.

* Contained in your letter No. 2393A., dated the 10th of June.

† Marked A. B. & C.

2. From these documents it will be seen by Statement A., that there were 30 vessels at the chain moorings off Calcutta when the gale took place on the 3rd June, 5 only of which lay secure, while 25 vessels broke adrift, leaving only 12 sets of moorings complete available. At Howrah the old set of moorings No. 1 were carried away by the two ships riding by them, leaving the new set No. 2 complete. At the Cooley Bazar, per Statement B., there were only two ships at the moorings, one of them lay secure and the other parted all her shackles; and it appears that partly by the force of the wind upon the buoys of the vacant moorings, and partly by the *Prince Albert* driving over them, dragging the ground chains from their position up and down the River, the buoys are now so intermixed that it is impossible, at some of the tiers, to distinguish the ebb and flood buoys from each other, so that the moorings at No. 3 and 4, though not lost, are "all adrift" till they can be hove up and re-laid during the fine weather season.

3. The Statement marked C. shows that of the 8 swinging moorings off the docks on the Howrah side, 3 of them parted during the gale. Three of the swinging moorings laid on the edge of the Sumatra likewise parted, Nos. 3 and 4, during the gale, and No. 7 subsequently, leaving 12 sets still complete. The three Pilot vessels' moorings off the Bankshall were also lost, as well as one at the Cooley Bazar above the Amherst's buoy, and two of the steamers' moorings at Kidderpore at a subsequent period. The cause of these vessels breaking adrift cannot, I fear, be accurately ascertained till the moorings are recovered and hove up, the Harbour Master's Department having as yet been able to recover and re-lay only three mooring anchors, and one of the Pilot vessels' moorings previous to the setting in of the freshes.

4. By these disasters only 22 set of chain moorings instead of 59, and 21 set of swinging moorings instead of 32, as per margin, remained for the security of the shipping during the freshes, and the consequence of which state of things has been much damage done to the shipping by the vessels moored in the stream breaking adrift on the springs, when it was impossible to avoid collision with each other from the crowded state of the harbour. There being upwards of 190 ships in the river during the greater part of last month, I beg to submit, for the Board's information, a Statement marked D., of 40 casualities which have occurred in the river between the 14th of July and 27th of August which by no means comprehends the whole of these misfortunes, as many accidents happened, of which I have received no written report either from the Commander or the Harbour Master.

Calcutta chain moorings	...	37
Cooley Bazar ditto	...	20
Sulkea ditto	...	2
		—59
Deficient.		
Calcutta ...	...	25
Cooley Bazar ...	...	1
Ditto, all adrift ...	...	10
Sulkea, parted ...	...	1
		—37
Chain moorings entire	...	... 22
Swinging moorings of, off docks		8
Ditto of Sumatra Sand	...	15
Ditto for Pilot Vessels	...	3
Ditto at Cooley Bazar	...	2
Ditto at Kidderpore	...	4
		—32
Deficient.		
Off Docks ...	...	3
Off Sumatra Sand ...	...	3
Pilot Vessels ...	...	2
Cooley Bazar ...	...	1
Kidderpore ...	...	2
		—11
Swinging moorings entire	... ...	21

5. When these accidents began to take place from the effects of the freshes, there were about 30 ships at the moorings and secured under fours. The Commanders and Agents soon became most calamorous to have their vessels placed in security under fours, and the calls upon the Harbour Master for his assistance were far beyond what his Department could promptly attend to; vessels were obliged to wait their turns, and loud were the complaints of delay in consequence. In this exigency the Harbour Master applied to me by letter, dated 13th ultimo, which accompanies, marked E., to be permitted under the Board' sanction to allow the individuals named in his letter who were candidates for employment as Assistant Harbour Masters to aid in the duties during this very great pressure upon his Department. I was unwilling to submit his proposition to the Board without laying before them, at the same time, more information of the necessity of such a step than was contained in Captain Gillett's letter; but he was authorized to employ such of the men as were willing to work upon a promise of being recommended for remuneration, should their services give satisfaction, and I am happy to say that by their assistance the Harbour Master was enabled to attend more promptly to the wants of the shipping, and in a few days he had upwards of 80 ships hauled under fours at the moorings and their own anchors in different parts of the river which tended to clear the Harbour greatly and to give satisfaction to all parties.

6. The assistance of these men were no longer required about the end of last month, when their services were immediately dispensed with, and I now beg to submit, for the Board's satisfaction, a Statement marked F. of the duties they performed; and should the Board concur with me in the pressing necessity for this prompt and adventitious aid being given by the Harbour Master, I trust they will sanction my drawing out a contingent bill for the services of these auxiliary hands at the rate of 4 Rupees per diem, for which I make no doubt they will be sufficiently thankful; and I beg likewise to solicit that the Board will sanction the substitution of Mr. J. Simson as Extra Assistant Harbour Master for Mr. A. Dunbane, who has rendered himself unworthy of further employment,* and that of Mr. C. A. Heald in lieu of Mr. Buary, resigned.

* *Vide* Harbour Master's letter marked G., herewith forwarded.

7. I take this opportunity likewise to submit Statement marked H. of the employment of the whole of the Harbour Master's Assistants from April to August last, and two Statements marked I. and K. of the Receipts and Disbursements in the Harbour Master's Department for the same period, all of which contain matter for the Board's information more or less connected with the purport of this letter.

A.

Statement of the Shipping at the Hon'ble Company's Chain Moorings, Calcutta, during the Gale of the 3rd June 1842.

Chain Moorings.	Vessels' Names.	Tonnage.	State of Preparation.	Parted or otherwise, and cause of parting.	Weight of Mooring Anchors.
TIER No. 1.					
1st or inside Berth ...	Canopus ...	365	Top gallant masts down ..	Parted the ebb moorings by carrying away the shackles.	
2nd Set ...	Roseanne ...	396	Ataunto ...	Ditto ditto.	
TIER No. 2.					
1st or inside Berth ...	Renown ...	325	Top gallant masts down ...	Lay secure.	
2nd Set ...	Juliana ...	574	Ditto ditto ...	Parted one of the ebb moorings by carrying away shackles.	
3rd Set ...	Lord Althorpe ...	230	Ataunto ...	Lay secure.	
TIER No. 3.					
1st or inside Berth ...	Guisachen ...	474	Ataunto ...	Parted by carrying away the ebb mooring shackles.	
2nd Set ...	Selma ...	258	Top gallant masts down ...	Ditto ditto.	
3rd Set ...					
TIER No. 4.					
1st or inside Berth ...	Potomac ...	383	Ataunto ...	Parted by carrying away the ebb mooring shackles.	
2nd Set ...	Senator ...	494	Ditto ...	Ditto ditto.	
3rd Set ...					
TIER No. 5.					
1st or inside Berth ...	Tigris ...	422	Ataunto ...	Parted by carrying away ebb and flood mooring shackles.	
2nd Set ...	Homanjee Bomanjee ...	850	Mizzen masts only ...	Parted by carrying away the flood mooring shackles.	
3rd Set ...	Agnes Ewing ...	541	Ataunto ...	Lay secure.	
4th Set ...	Julia ...	785	Lower masts only ...	Parted her flood mooring shackles and one ebb ditto.	
5th Set ...					
TIER No. 6.					
1st or inside Berth ...	Warrior ...	387	Top gallant masts struck ...	Parted both ebb mooring shackles and one flood ditto.	
2nd Set ...	David Malcolm ...	538	Top gallant masts down ...	Parted both ebb and flood shackles.	
3rd Set ...	John Adams ...	499	Lower masts only ...	Ditto ditto.	
4th Set ...	Santow ...	345	Top gallant masts down ...	Ditto ditto.	
TIER No. 7.					
1st or inside Berth ...	Chilo ...	417	Ataunto ...	Ditto ditto.	
2nd Set ...	Persian ...	408	Top gallant masts and mizzen top mast struck...	Parted ebb shackles.	
3rd Set ...	Patriot King ...	547	Ditto ditto ...	Ditto ditto.	
4th Set ...	New Jersey ...	636	Ataunto ...	Parted her ebb mooring shackles and capsized her flood anchor and dropped down to No. 5.	
TIER No. 8.					
1st or inside Berth ...					
2nd Set ...	Old England ...	502	Top gallant masts down ...	Parted her ebb and flood mooring shackles.	
3rd Set ...	Regina ...	800	Ditto ditto ...	Parted her ebb mooring shackles.	
4th Set ...	Mohussa ...	750	Top masts down ...	Ditto both ebb and flood.	
5th Set ...					
TIER No. 9.					
1st or inside Berth ...	Meg of Meldow ...	396	Ataunto ...	Parted one ebb and one flood mooring shackle.	
2nd Set ...	Steamer Futtle Currim ...	333	... ...	Lay secure.	
3rd Set ...	Hashmony ...	323	... ...	Ditto.	
4th Set ...					
TIER No. 10.					
1st or inside Berth ...	James Turcan ...	332	Ataunto ...	Parted her ebb mooring shackles.	
2nd Set ...	Bk. Futtle Currim ...	325	... ...	Parted from the ebb pile.	
3rd Set ...					
4th Set ...	Eleanor Lancaster ...	480	Top gallant masts down ...	Parted all her shackles and went ashore.	

Inside from 50 to 60 Cwt.
Outside from 60 to 65 do.

No. 1. Fixed Moorings at Sulkeah parted by the ships *Cavendish*, *Bentinck* and *Lady Clifford* during the gale of the 3rd June ... Not recovered.
Ditto ditto ... Complete.

A. GILLETT,
Harbour Master.

HARBOUR MASTER'S OFFICE,
The 2nd September 1842.